After the administration of $CH_2NH_2C^{14}-O_2H$ (5 mg 1.2×10^4 cpm) to each silkworm larva on the 3rd-4th day of the 5th instar, silk fibroin (I) is isolated from posterior gland, by washings with 0.14 M and M NaCl, distilled water, EtOH, and ether in order, and the radioactivity of I is determined. The labelled glycine is shown to be incorporated non-uniformly, but it is present predominantly in N-terminal amino acids of I molecule. (CA 50: 1956, 10288a)

285 Simmons, J.R. STUDIES OF AMINO ACID INCORPORATION IN THE LARVAE OF Drosophila melanogaster. Thesis, California Inst. of Tech., Pasadena, Biology Div. 1961.

C^{14}-labelled amino acids were injected into the haemolymph of larvae. The resulting pattern of incorporation was investigated by direct paper chromatography of the injected larvae and by column fractionation of larval extracts. Injected amino acids were rapidly incorporated into a large number of components, many of them peptides, others containing non-amino acid constituents of unknown nature. A major portion of the amino acids in insect haemolymph occur in bound form. In order to obtain larger amounts of amino acids in non-protein-bound forms, attemps were made to inhibit protein synthesis. Of the treatments tested only Metrazol and chlorpromazine were effective in reducing protein synthesis and this reduction was accompanied by a decrease in amount in all radioactive metabolic product. The possible significance of this reduction is discussed. Material containing bound C^{14}-glutamic acid was isolated from larval extracts and reinjected. Radioactivity from the injected material was found to be incorporated into the protein of the larvae but at a slower rate than was the free amino acid. The implications are discussed.

286 Simmons, J.R., Mitchell, H.K. METABOLISM OF PEPTIDES IN Drosophila. p.147-55 in "Amino Acid Pools. Distribution, Formation and Function of Free Amino Acids. Proceedings of a Symposium on Free Amino Acids held at the City of Hope Medical Centre, Duarte, Calif., U.S.A., May 1961". Holden, J.T., Ed. Amsterdam, Elsevier Publishing Company. 1962.

By means of a special apparatus large numbers of larvae could be injected with as little as 0.05 µl, with an error of ca. ± 25%. For studies of incorporation of amino acids in time series, larvae were injected and washed, placed on filter paper and squashed. n-Propanol-1% aqueous ammonia (3:1) was used mostly for chromatography. Radioactive (C^{14}-labelled) L-glutamic acid (4 µc/15µl), L-leucine (10 µc/20µl) and L-valine (10 µc/20 µl) were used, isolated fractions being reinjected in some experiments. It is concluded that the injected amino acids are very rapidly incorporated into peptides of various sizes. Subsequently they enter into proteins, but the mechanisms of synthesis are not understood. In initial stages, mixed peptides containing C^{14}-labelled glutamic acid are incorporated into proteins at about the same rate as glutamic acid itself but whether the peptides are incorporated directly or are first hydrolyzed remains an open question. Glutamic acid (glycine, alanine and aspartic acid behave similarly) goes very rapidly into peptides and relatively slowly into proteins. It is widely distributed in bound form (peptides). Leucine and valine, however, which are amino acids essential to Drosophila, appear in relatively few peptides more directly and rapidly in proteins. Chloramphenicol and p-fluorophenylalanine had no influence on the rate of incorporation of amino acids into proteins in this in vivo system, even when saturated solutions were injected. So far, no inhibitors have been found which specifically inhibit protein synthesis in the larvae.

287* Sirlin, J.L., Knight, G.R. PATTERN OF PROTEIN SULFUR AFTER FEULGEN HYDROLYSIS IN THE SALIVARY GLAND CHROMOSOMES OF Drosophila melanogaster. Chromosoma 9 (1958) 119-59.

The residual non-histone protein in the chromosomes was studied by means of high-resolution autoradiography after feeding with methionine-S^{35} throughout larval life. (From EM 14, I: 1960, 3962)

288* Sirlin, J.L., Knight, G.R. CHROMOSOMAL SYNTHESES OF PROTEIN. Exp. Cell. Res. 19 (1960) 210-19.

Drosophila melanogaster and D. virilis were used. Salivary chromosomes labelled in vivo for short times with methionine-S^{35} or C^{14} and leucine-H^3 show a pattern of labelling that resembles qualitatively that in chromosomes labelled throughout larval life with methionine-S^{35}. The autoradiographs of discrete chromosomal regions, on which that pattern is based, are not displaced after withdrawal of tracer or effaced by treatment with KCN as an unfolding agent. It is concluded that the pattern of labelling originally described represents a pattern of localized protein syntheses superimposed on the protein backbone of the chromosome. Several possible aspects of this pattern are discussed. (Essentially auth. summary)

289 Skinner, D.M. INCORPORATION OF LABELED VALINE INTO THE PROTEINS OF THE Cecropia SILKWORM. Biol. Bull. 125, 1 (1963) 165-76.

Brainless, diapausing pupae of Platysamia cecropia were each injected with 2.6 μc valine-1-C^{14}. Various tissues were removed from which the proteins were precipitated, washed, and plated, and the radioactivity measured. The rates of incorporation of proteins into the tissues were reported as specific activities representing cpm/mg protein. In 16 animals the specific activity in blood, fat body, epidermis, and midgut 12 h after injection of valine-1-C^{14} was 0, 40, 100, and 280 respectively. In 31 animals injected with similar doses of labelled valine on the 2nd or 3rd day after initiation of adult development, at the end of 12 h after injection, the specific activity in blood, fat body, gut, and epidermis was 100, 300, 825, and 1425, respectively. There was a further increase in incorporation in some tissues by the 17th day of development. The specific activity of eggs, epidermis, blood, fat body, and muscle at 5 h after injection was 1600, 1600, 900, 175, and 1200, respectively. The blood proteins were 15-16 times more highly labelled than those of 2- or 3-d-old animals. Fat body showed little ability to incorporate amino acids. When animals were injured by removal of the cuticle in the facial region, the uptake of labelled valine by blood, fat body, gut, and epithelium was greatly increased. Injections of 0.04 ml 10% MeOH in insect Ringer's solution, and 4000 Calliphora units of purified ecdysone in 0.04 ml 10% MeOH in insect Ringer's solution both greatly increased the amount of labelled amino acid incorporated into protein. Ecdysone release has 2 effects on a diapausing animal: to increase metabolism, and to reroute metabolic pathways toward growth and differentiation. Injury can duplicate the first effect but not the 2nd. The radioactivity of subcellular fractions of thoracic muscle was measured in 12 animals on the 17th and 21st day of adult development. Two hours after injection of 2.6 μc valine-1-C^{14}, the specific activities in 17-d-old animals were reported as 911, 766, 678, and 604 for microsomes, myofibrils, soluble cell fraction, and sarcosomes, respectively. For the same cell fractions in 21-d-old animals, the specific activities were 566, 320, 385, and 343, respectively. Hence, amino acids were incorporated into all cell fractions. (CA 59: 1963, 14336b)

290 Stevenson, E., Wyatt, G.R. THE METABOLISM OF SILK MOTH TISSUES. I. INCORPORATION OF LEUCINE INTO PROTEIN. Arch. Biochem. Biophys. 99, 1 (1962) 65-71.

Fat body tissue from larvae and pupae of saturniid silkmoths* was incubated with leucine-1-C^{14}, and incorporation into total protein was measured. Midgut tissue was also used in a few experiments. In a medium of salts and amino acids based on the composition of silkworm haemolymph, incorporation by fat body is linear for at least 6 h, whereas some media give declining rates, and in severely hypotonic media, or with homogenates, incorporation is virtually abolished. In fat body from mature larvae the rate of amino acid incorporation is high; in tissue from diapausing pupae it has fallen to about 0.3% of the larval rate; and by an early stage of adult development it has risen again to about 10% of the larval rate. The activity of fat body and midgut also rises after integumentary injury to diapausing pupae. In fat body, the effect on amino acid incorporation was first evident in tissue taken 14 h after the injury; by 7 d it had become maximal (50-70 times the pre-injury rate); and thereafter the activity declined toward the pre-injury rate (Auth.)

* (Hyalophora cecropia, Antheraea polyphemus and Samia cynthia)

291 Strong, F.E., Sakamoto, S.S. SOME AMINO ACID REQUIREMENTS OF THE GREEN PEACH APHID, Myzus persicae (Sulzer), DETERMINED WITH GLUCOSE-U-C^{14}. J. Insect Physiol. 9, 6 (1963) 875-9.

After feeding through a membrane on a solution of glucose-U-C^{14}, M. persicae was found to synthesize alanine, aspartic acid, serine, glutamic acid, glycine, cystine, and two unidentified amino acids. Asparagine, recovered as aspartic acid, was also synthesized. Threonine, valine, leucine, isoleucine, lysine, phenylalanine, methionine, and arginine were not synthesized to any appreciable extent and are considered to be nutritionally essential. Tyrosine was not synthesized and has been classified as essential pending further investigations to elucidate a phenylalanine to tyrosine synthesis. (Auth.)

292 Suto, S., Shimura, K. STUDIES ON THE BIOSYNTHESIS OF SILK FIBROIN. III. IN VIVO INCORPORATION OF GLYCINE-C^{14} INTO PROTEINS OF POSTERIOR SILK GLAND FRACTIONS. J. Biochem., Tokyo 49 (1961) 69-76.

By differential centrifugation at 1000, 3900, 15000, and 105000 g successively the homogenate of posterior silkgland in 0.35 M sucrose was fractionated into R(residue), M(mitochondria), L(large microsomal granules), S(small microsomal granules), and soluble supernatant. RNA-containing microsomes were released from R by deoxycholate treatment. RNA was highest in S, lower in M and L, and absent

from the soluble fraction. M and L were rich in phospholipides. R contained a large amount of fibroin. The 4 sedimenting fractions were examined for C^{14} following the injection of glycine-1-C^{14} (specific activity of 0.1 mc/2.2 mg). R showed an initial, temporary rise in C^{14} incorporation, presumably to its microsomal moiety, and later incorporation of C^{14} to fibroin of R proceeded when C^{14} radioactivities of L, M, and S fractions were decaying. Microsomes in heterogeneous states in R, M, L, and S fractions play a role in taking up glycine for protein synthesis. (Parts of this paper were presented at the annual meetings of the Agricultural Chemical Society of Japan, Kyoto 1958 and Tokyo 1959).

293 Suto, S., Shimura, K. ELECTRON MICROSCOPIC AND SOME BIOCHEMICAL STUDIES ON THE CELL FRACTIONS OF SILKGLANDS. Tohoku J. agric. Res. 12, 3 (1961) 263-80. (In English)

Glycine-1 C^{14} (specific activity 4.1 mc/mM) was injected into silkworms (see 292 for details, also of cell fractionation, chemical assays of RNA phosphorus, total N and glycine). Enzyme assays, sample preparation for electron microscopy, and subfractionation of the cellular fractions obtained from homogenizing the posterior silk glands into fractions M, L, and S are described. Following injection of 5000 cpm/silkworm of glycine-1-C^{14} the incorporation of the glycine into the proteins of the subfractions was studied. The initial rise in radioactivity was predominantly in the deoxycholate-insoluble proteins, the radioactivity in the soluble proteins increasing more slowly and linearly. Recoveries of RNA in the insoluble subfractions were 85, 80 and 77% for M, L, and S, respectively. L showed the highest acid phosphatase and ribonuclease activities. Electron microscopic observations revealed microsomal structure in all particulate fractions; L contained electron-dense granules, S small microsomal vesicles and free Palade particles.

294 Suzuka, I., Tanaka, S., Shimura, K. AMINO ACID-ACTIVATING ENZYME FREE FROM PYROPHOSPHATE EXCHANGE. J. Biochem. Tokyo, 49 (1961) 80-2.

Amino acid-activating enzyme (I) is purified from N_s fraction of posterior silk gland of Bombyx mori by $(NH_4)_2SO_4$ fractionation (0.6 - 0.8 saturation) at pH 8, removing the impurities by centrifuging off the precipitates at pH 4.5, and precipitating (I) at pH 8.0 by 0.8 saturation with $(NH_4)_2SO_4$. (I) activates incorporation of C^{14}-labelled glycine and alanine into deoxycholate-treated particulate of silk gland of B. mori in the presence of the incorporation enzyme and ATP (adenosine triphosphate). Unlike the N_s-fraction, the action of (I) does not accompany any appreciable exchange reaction between P^{32}-labelled pyrophosphate and ATP. (I) is inactivated by heating (95°C for 3 min) and is stable for as long as 3 d at -10°C. Amino acid activation by way of amino acyl adenylate is suspected. (From CA 55: 1961, 13483e)

295 Suzuka, I., Tanaka, S., Shimura, K STUDIES ON THE BIOSYNTHESIS OF SILK FIBROIN. IV. A PARTICULATE FRACTION CONTROLLING THE SPECIFICITY OF FIBROIN SYNTHESIZED IN A CELL-FREE SYSTEM. J. Biochem. Tokyo 52, 1 (1962) 54-8.

Relative rate of incorporation of glycine-1-C^{14} (I), DL-alanine-1-C^{14} (II) and DL-leucine-1-C^{14} (III) is determined in the cell-free system, consisting of 1% deoxycholate-treated, 20 000 g-precipitated particulate fraction (IV), amino acid-incorporating supernatant enzyme (V), amino-acid activating enzyme (VI), adenosine triphosphate, Mg^{++}, and amino acid mixture. IV, V, and VI prepared from Bombyx mori, Attacus ricini, and rat liver, can replace the respective fractions of different animals. The maximum incorporation rate of I, II, and III is attained by using the IV preparations from B. mori, A. ricini, and rat liver, respectively, regardless of the source of V and VI. A. ricini is more unstable than IV of B. mori or rat liver, especially the activity towards I. (CA 58: 1963, 8164g)

296 Szafranski, P., Lutowicz, J., Puzynska, L. THE AMINO ACID CODE AND BIOSYNTHESIS OF THE SILK. Life Sci. 11 (1963) 845-51.

Silkglands of the silkworm are useful since in a cell-free system polynucleotides may lead to information on the synthesis of a given polypeptide, and the glands produce fibroin and sericin of a known and very specific amino acid composition. RNA from posterior and middle silkglands (5th instar Bombyx mori) was fractionated and the nucleotide composition established for each fraction. Based on the content of amino acids in the silk protein the nucleotide composition of the so-called "messenger RNA" (mRNA) was calculated and compared with the composition of received fractions. The influence of those fractions upon the incorporation of the C^{14}-labelled amino acids (specific for silk) into the cell-free system from E. coli was then investigated. After P^{32}-incorporation into the glands, middle and posterior RNA was separated out. Results are tabulated and discussed.

297 Tanaka, S. TRANSFER OF RADIOACTIVITY FROM RELABELED CELL DEBRIS TO PARTICULATE FRACTIONS IN THE POSTERIOR SILK GLANDS. Seikagaku Zasshi 33 (1961) 390-9.

Amino acid-incorporating activity of posterior silk glands was studied on the sub-cellular level. Posterior silk glands of Bombyx mori were homogenized and centrifuged to give cell debris (CD), large particles (RL), small particles (E_1), a fraction (E_2) containing amino acid-incorporation enzyme, and a fraction (E_3) containing amino acid-activating enzyme. To prepare C^{14}-labelled CD in vivo, 2 μc of glycine-2-C^{14} was injected into a silkworm, and the above procedure was undertaken. Incubation of sliced glands with glycine-2-C^{14} and the subsequent homogenization was employed to prepare C^{14}-labelled CD in vitro. Transfer of radioactivity from C^{14}-labelled CD to E, reached an equilibrium in 15 min, and required the presence of an amino acid mixture, guanine triphosphate, an energy source such as creatine plus creatine kinase, and E_2 but not E_3. Transfer of the radioactivity to RL was also observed under similar incubating condition, but inhibition was induced by the pre-treatment of C^{14}-labelled CD with either ribonuclease (100 γ/ml), deoxyribonuclease (100 γ/ml), deionized water, or deoxycholic acid (0.5%). Chloramphenicol (10^{-4} M), N mustard (10^{-5} M), and 2,4-dinitrophenol(10^{-4}M) did not inhibit the transfer reaction. (CA 55: 1961, 23843g).

298 Tanaka, S., Suzuka, I., Shimura, K. INTERACTION OF ADENOSINE TRIPHOSPHATE (ATP) WITH GLYCINE-ACTIVATING ENZYME. J. Biochemie, Tokyo 51 (1962) 447-9.

The crude glycine(I)-activating enzyme (II) preparation of the posterior silk gland of Bombyx mori was further purified by precipitating with $(NH_4)_2SO_4$ (100% saturation) and by freeing from ribonucleic acids by diethylaminoethyl cellulose column chromatography. Upon incubation of II with ATP-8,γ-P^{32} at pH 8.0 (37°C, 10 min) the formation of II-ATP-P^{32} (III) is demonstrated as a single fraction in paper electrophoresis at pH 8.0, and also a major component in starch zone electrophoresis at pH 8.0, accompanied by a minor III component. The formation of III requires Mg^{++}. III can be precipitated by saturating with $(NH_4)_2SO_4$ to remove free ATP, and is shown to contain less than 1 mol of ATP/mol of II. In the presence of ribosomal amino acid-incorporating enzyme (IV) and 19 amino acids, purified III more effectively incorporates I-C^{14} into the synthesized protein than a mixture of ATP, I-C^{14}, II, IV, and amino acids. A specific activation of I catalyzed by III, but not by free II, is suggested. (CA 57: 1962, 10218i)

299 Umebachi, Y. YELLOW PIGMENTS IN THE WINGS OF PAPILIONID BUTTERFLIES. VI. RED PIGMENTS OF THE PAPILIONID AND NYMPHALID BUTTERFLIES. Sci. Rep. Kanazawa Univ. 8, 1, (1962) 127-33.

The red brown scales of Papilio protenor on alkaline hydrolysis yielded no xanthurenic acid. Therefore, type B red pigment in the Papilionidae may not be an ommochrome. A similar treatment of type C red pigment of Vanessa indica indicates an ommochrome pigment. Autoradiographs of Graphium sarpedon, whose prepupa had been injected with tryptophan-C^{14}, indicated no incorporation of tryptophan in the type A red wing pigment. Similar treatment of V. indica indicated the incorporation of tryptophan into type C red pigment. (CA 59: 1963, 9120d)

300 Umebachi, Y. YELLOW PIGMENTS IN THE WINGS OF PAPILIONID BUTTERFLIES, VII. CONSIDERATION OF THE NATURE AND DISTRIBUTION OF THE WING PIGMENTS OF THE PAPILIONID BUTTERFLIES. Sci. Rep. Kanazawa Univ. 8, 1 (1962) 135-42.

The yellow pigments of Papilio xuthus, papiliochrome-II and -III, although derived from tryptophan, are not ommochromes since many of their reaction are different. These papiliochromes are probably kynurenine jointed to some substance, perhaps dopa derived o-diphenol. In Papilionidae wings these kynurenine pigments and anthoxanthin are usually mutually exclusive. The yellow kynurenine pigment and type B red pigment may be characteristic of the Papilionidae. Since the pterin pigment is characteristic of the Pieridae and the ommochrome pigment (type C red pigment) is characteristic of the Vanessidi of Nymphalidae, many systematic groups have their own characteristic pigments. These characteristic pigments are synthesized by the animals whereas the anthoxanthin pigment is derived from the plant food of the larva of a widely distributed group of Lepidoptera. Perhaps this last pigment is the pigment of the common ancestor of the Pieridae and Papilionidae. (CA 59: 1963, 9120e)

301 Vanderberg, J.P. THE ROLE OF THE GONADOTROPIC HORMONE IN THE SYNTHESIS OF PROTEIN AND RNA (RIBONUCLEIC ACID) IN Rhodnius prolixus. Biol. Bull. 125, 3 (1963) 576-81.

The hormone from the corpus allatum in R. prolixus is necessary for deposition of yolk in its oöcytes. Incorporation of H^3-labelled precursors of DNA (thymidine-H^3), RNA (uridine-H^3), and protein (leucine-H^3) were studied with bugs decapitated in such a way as to either leave or remove the corpus allatum; the

allatectomized bugs showed little difference from the control in DNA synthesis, but RNA and protein synthesis were drastically reduced by removal of the gland. (CA 60: 1964, 9654g)

302 Winteringham, F.P.W., Harrison, A. INCORPORATION OF [2-C^{14}] ACETATE INTO ACETYLCHOLINE OF THE ADULT HOUSEFLY IN VIVO UNDER CONDITIONS OF REST, ACTIVITY AND INSECTICIDAL ACTION. Biochem. J. 78 (1961) 22P.

The [C^{14}]acetylcholine formed in vivo following the intrathoracic injection of [2-C^{14}]acetate into adult Musca domestica was separated by paper chromatography from the other labelled compounds formed and then assayed radiometrically. Maximum specific radioactivity of the acetylcholine fraction was rapidly achieved within 15 min. Anticholinesterases appeared to "uncouple" acetylcholine synthesis in the sense that the overall metabolism of [C^{14}]acetate and respiration were increased while formation of [C^{14}]acetylcholine was considerably reduced. The effect of malathion on [C^{14}]acetylcholine formation was partly reversed on injecting pyridine-2-aldoxime methiodide together with atropine but, unlike the case of diisopropyl phosphorofluoridate, there was no reversal of the outward signs of poisoning. Dieldrin directly affected the metabolism of acetylcholine in vivo.

303 Winteringham, F.P.W., Disney, R.W. RADIOMETRIC ASSAY OF ACETYLCHOLINESTERASE. Nature, Lond. 195 (1962) 1303.

A method is described for the microdetermination of acetylcholinesterase activity in which the formation of acetic acid labelled with C^{14} liberated enzymically from the labelled substrate, is measured by a simple counting technique. The method has the advantage that it can be applied to very small samples of tissue at relatively constant pH. Tests on diluted cholinesterase-active tissue extracts from Musca domestica head are discussed. The technique provides a reliable indicator of reversible cholinesterase inhibition by such compounds as carbamates, for example.

304 Winteringham, F.P.W., Disney, R.W. ACETYLCHOLINESTERASE ACTIVITY AND COMPETITIVE INHIBITION AT LOW SUBSTRATE CONCENTRATIONS. Biochem. J. 88, 3 (1963) 67-68p.

The study of acetylcholinesterase activity over a wide range of substrate concentrations (0.05 - 0.00005 M) is facilitated by radiometric methods. Head tissue of adult Musca domestica and haemolysates of human whole blood were used for enzyme preparation. The effective Michaelis constant, the dissociation constant for the further reaction between normal enzyme-substrate complex and free substrate, and the dissociation constant for the reaction between inhibitor and free enzyme have been evaluated for both preparations in the presence of the insecticide o-isopropoxyphenyl-N-methyl carbamate. The observed and calculated decreases in apparent enzyme inhibition as a result of sample dilution or increasing substrate concentration were in fair agreement. The observations are believed to be of significance in studies of the cholinesterase inhibition and toxicity relationships of the carbamate insecticides and in the measurement of blood cholinesterase inhibition as a result of carbamate exposure in man.

305* Weygand, F. ZUR BIOGENESE DES LEUCOPTERINS. (On the biogenesis of leucopterin). Angew. Chem. 71, 23 (1959) 746. (In German).

On injecting glucose-1-C^{14} into 3-4 d old pupae of the cabbage moth, Pieris brassicae, 53% of the total radioactivity incorporated in leucopterin are found in C-8 and -9. With glucose-2-C^{14} as much as 78% are found there. This and other evidence suggest that the ribose carbon-1 atom is a precursor of C-8 of the pterin.

306* Weygand, F., Simon, H., Schliep, H.J., Dahms, G. ÜBER DIE BIOGENESE DES LEUCOPTERINS. II. MITTEIL. (Further study on the biogenesis of leucopterin). Angew. Chem. 71, 15/16 (1959) 522. (In German).

The distribution of the radioactivity in leucopterin was determined after CH_3CO_2H-1-C^{14}, CH_3CO_2H-2-C^{14}, glycine-2-C^{14} (I), and D-glucose-1-C^{14} (II) were injected into larvae and pupae of Pieris brassicae. I was the main supplier of C atoms 4 and 5, and II of 8 and 9. (CA 54: 1960, 5966e).

307 Weygand, F., Simon, H., Dahms, G., Waldschmidt, M., Schliep, H.J., Wacker, H. BIOSYNTHESIS OF LEUCOPTERIN. Angew. Chem. 73 (1961) 402-7.

To investigate the synthesis and structure of leucopterin (I) C^{14}-labelled purines, pyrimidines, and formic acid and glycine-1-C^{14} are injected into pupae of Pieris brassicae. Formic acid was the precursor of the

310 Bensam, A., Kitazume, Y., Yeas, M. RIBONUCLEIC ACID METABOLISM IN THE SILK GLAND. Exp. Cell. Res. 31, 2 (1963) 329-39.

Larvae of Bombyx mori were used at the end of the last instar, between 4 and 2 d before spinning. Some of the initial work was done on larvae of Telea polyphemus. Larvae were injected dorsally with 10-100 µl of neutralized P^{32} orthophosphate or C^{14}-2-glycine. Two methods were used to prepare RNA. To confirm and extend previous results the composition of the RNA from anterior and posterior parts of the silk gland of B. mori was redetermined. Ion exchange chromatography and paper electrophoresis were used. Earlier analytical results on the composition of RNA from Lepidopteran silk glands were confirmed. Pulse labelling failed to detect a rapidly labelled RNA fraction with a composition different from bulk RNA.

311 Bier, K. UNTERSCHIEDLICHE REPRODUKTIONSRATE IM EU- UND HETEROCHROMATIN: EIN WEG ZUR KERNDIFFERENZIERUNG? (Differential reproduction rate in eu- and heterochromatin: a means of nuclear differentiation?) Zool. Anz., Suppl. 25 (1962) 102-10. (In German)

H^3-thymidine was used a specific DNA-precursor. A number of Diptera are considered. Nuclear differentiation, as manifested in the size ratio of chromocentre to nucleus in nurse cells of low as well as high polyploidy and in proximal and distal nuclei, is interpreted as the result of differential rates of synthesis in euchromatin and heterochromatin. A lowering in reduplication in heterochromatin is not directly dependent on the kind of tissue or degree of polyploidy but rather the result of its function which here depends on the position of the nucleus relative to the oöcyte.

312 Bier, K. SYNTHESE, INTERZELLULÄRER TRANSPORT, UND ABBAU VON RIBONUKLEINSÄURE IM OVAR DER STUBENFLIEGE Musca domestica. (Synthesis, intercellular transport, and breakdown of ribonucleic acid in the ovary of the housefly, Musca domestica). J. cell. Biol. 16, 2 (1963) 436-40. (In German, with English summary).

Short incubation with tritiated RNA-precursors up to 30 min produces equally high levels of activity in all nurse cells. During this period, tritiated RNA streams from the heavily labelled nurse cell nuclei to the periphery of the trophocytes. Incorporation periods for 45 min or more lead to spots of intense activity in the oöcyte near the intercellular bridges (Fusomes) connecting the proximal nurse cells and the oöplasm. From 1 h after injection onward the activity diminishes in all nurse-cell nuclei and in the cytoplasm of the smaller distal nurse cells. This is considered as evidence of RNA-transport from the nurse chamber into the growing oöcyte. As the insoluble compound of the tracer (i.e., RNA of high molecular weight) does not accumulate in the oöcyte, a high turnover of RNA entering the oöcyte via the intercellular bridges is assumed. It is pointed out that the processes described in this paper are similar to what is to be expected for messenger-RNA. (Auth. summary)

313 Durand, M., Séréno, C. THE SYNTHESIS OF RIBONUCLEIC ACID (RNA) BY THE OVARY OF THE CRICKET. C.R. Acad. Sci., Paris 253 (1961) 556-8.

By means of autoradiography, uptake of tritiated adenosine by the ovary of the cricket (Gryllus bimaculatus) was examined as previously described. Free adenosine and low molecular weight polynucleotides were particularly high after cytoplasmic increase of oocytes and at the beginning of vitellogenesis. In follicular cells, all radioactivity observed in the nucleus was removed by ribonuclease. Not all cells surrounding the oocyte contained radioactivity. In labelled cells, RNA was found in 3 modes: in chromatin only, in nucleolus, and in both chromatin and nucleolus. (CA 56: 1962, 12098d)

314 Favard-Séréno, C.*, Durand, M. L'UTILISATION DE NUCLÉOSIDES DANS L'OVAIRE DU GRILLON ET SES VARIATIONS AU COURS DE L'OVOGENÈSE. I. INCORPORATION DANS L'ARN. Devl Biol. 6, 2 (1963) 184-205.

The uptake of tritiated uridine and cytidine in the RNA of the cricket ovary (Gryllus bimaculatus, Orthoptera) is described in terms of the duration of incorporation and of the physiological condition of the follicles. In the follicle cells, chromosomes are the primary site of RNA synthesis. With increasing incorporation time, labelled RNA moves towards the nucleolus, where it accumulates. Afterward, the radioactivity reaches the cytoplasm. The nucleoli lose their labelled material when the cytoplasmic activity is maximal. The speed of the migration from the nucleus to the cytoplasm depends on the secretory activity of the follicle cells: the more important the activity, the shorter the diffusion time.

* See also Séréno: 313, 345, 346.

This fact supports the hypothesis that the labelled RNA of the nucleus released to the cytoplasm is "messenger" RNA. In the oöcyte, the uptake of uridine and cytidine is at first visible in the nuclear sap. Later on, the labelled RNA accumulates in the chromosomes and in the oöplasm. Although high during cytoplasmic growth, the RNA activity drops, in the oöcyte, soon after the beginning of vitellogenesis. (Auth.)

315 Favard-Séréno, C., Durand, M. L'UTILISATION DE NUCLÉOSIDES DANS L'OVAIRE DU GRILLON ET SES VARIATIONS AU COURS DE L'OVOGENÈSE. II. INCORPORATION DANS L'ADN. Devl Biol. 6, 2 (1963) 206-218.

After thymidine injection, the number of labelled follicle nuclei increases when the secretory activity starts and, after 5 minutes of incorporation, approximately one-third of the nuclei are radioactive during the middle stage of vitellogenesis. Later on, there is no further rise in the number of labelled nuclei with increased treatment time. Between the first and the middle stages of vitellogenesis, the radioactivity becomes higher in the nuclei in relation with the increasing amount of DNA per polyploid follicle nucleus. No uptake of thymidine is visible in the germinal vesicle. When the secretory activity of the follicle cells reaches its maximum, radioactive DNA occurs in their cytoplasm and in the oöplasm. During vitellogenesis, and following long treatment time, uridine is incorporated into DNA in the same way as thymidine At the middle stage of vitellogenesis, cytidine follows a special pattern of incorporation: 24 h after injection, the DNA labelling extends to 100% of the follicle nuclei. The origin of the late DNA precursor is discussed. (From auth.)

316 Ficq, A., Pavan, C. METABOLISM OF NUCLEIC ACIDS AND PROTEINS IN GIANT CHROMOSOMES. Path. Biol. Sem. Hôp. 9 (1961) 756-7.

Autoradiographs are shown for the incorporation of tritium-labelled cytidine, uridine, lysine, and leucine (I) into giant chromosomes of the salivary glands of larvae of Rhynchosciara angelae. I was incorporated into an unstable protein with great metabolic activity, more closely associated with the ribonucleic acid than with the deoxyribonucleic acid of the chromosome bands. (CA 55: 1961, 19049c)

317 Fujita, S., Takamoto, K. SYNTHESIS OF MESSENGER RNA (RIBONUCLEIC ACID) ON THE POLYTENE CHROMOSOMES OF DIPTERAN SALIVARY GLAND. Nature, Lond. 200 (1963) 494-5.

Tritiated uridine (1-5 μc) mixed with 5-10 mM unlabelled thymidine was injected in larva of Brillia spp. (Chironomidae). Salivary glands were fixed ½ to 48 h after injection, paraffin sections prepared, and autoradiographs made. Patterns of Ag grains on and about the chromosomes suggest that specific regions of deoxyribonucleic acid (DNA) in the chromosomes are inactivated by a folding process to mask portions of the DNA to regulate formation of messenger RNA. (CA 60: 1964, 2084f)

318 Гинзбург, Г.И. АВТОРАДИОГРАФИЧЕСКОЕ ИССЛЕДОВАНИЕ ВКЛЮЧЕНИЯ ТИМИДИНА-H В ПРОЦЕССЕ ОВОГЕНЕЗА. Ж. общ. Биол. 24, 1 (1963) 71-3.

Gintsburg, G.I. AUTORADIOGRAPHIC INVESTIGATION OF THYMIDINE H^3 INCORPORATION DURING OÖGENESIS. Zh. obshch. Biol. 24, 1 (1963) 71-3.

To solve the problem of ways of "reserve" DNA accumulating in the cytoplasm of the oöcyte, 3-5 c/g H^3-labelled thymidine was injected into the abdomen of Coreus marginatus females. Ovaries were fixed after 3-180 min. No considerable incorporation into the nuclei of ovarial cells could be found after 30 min. After 60-180 min heavy labelling occured in the feeding cells and nearly all the follicular cells of the growing oöcytes but only in individual cells of oöcytes which had just started to grow or had terminated growth. No incorporation into embryonic vesicles was found. Along with the incorporation of the label into the follicular cells, it was incorporated into the cytoplasm, and was retained even after treatment with RNAse. Sometimes considerable incorporation into the oöcyte membrane was noticed, as well as a shift into the cytoplasm of follicular cells (toward the oöcyte) of the nuclear substance stained with methyl green. The nuclear stain with methyl green and Feulgen in follicular cells was always more intensive than that in feeding ones. All this suggested that during intensive growth of the oöcyte the cells are in a state of high metabolic activity and seem to be able to participate in the accumulation of nutritive substances and DNA derivatives in the oöcyte. (From English summary)

319 Henderson, S.A. DIFFERENTIAL RIBONUCLEIC ACID SYNTHESIS OF X (CHROMOSOME) AND AUTOSOMES DURING MEIOSIS. Nature, Lond. 200 (1963) 1235.

Ribonucleic acid (RNA) biosynthesis was followed autoradiographically through all stages of male meiosis in the locust Schistocerca gregaria, using H^3-uridine. All autosomes actively synthesize RNA throughout the whole of first meiotic prophase. Synthesis decreases progressively during diakinesis, as chromosome coiling becomes more and more complete, and has ceased by the time that nuclear membrane breakdown occurs. No RNA precursor is incorporated into any autosome during first metaphase or anaphase. Throughout most of meiosis the single X-chromosome is allocyclic relative to the autosomes. No RNA precursor is incorporated and the X-chromosome is unlabelled throughout its entire length. (CA 60: 1964, 8385g)

320 Hosoda, J., Shigematsu, H., Takeshita, H., Mizumo, S., Takahashi, H., Maruo, B. RIBONUCLEIC ACID METABOLISM IN THE POSTERIOR SILKGLAND OF SILKWORM, Bombyx mori, DURING THE FIFTH INSTAR. Biochim. biophys. Acta Previews 3, 3 (1963).

See 321.

321 Hosoda, J., Shigematsu, H., Takeshita, H., Mizumo, S., Takahashi, H., Maruo, B. RIBONUCLEIC ACID (RNA) METABOLISM IN THE POSTERIOR SILK GLAND OF SILKWORM (Bombyx mori) DURING THE FIFTH INSTAR. Biochim. biophys. Acta 72, 4 (1963) 544-54. (In English).

The base composition of the bulk RNA did not change significantly during the instar. P^{32}-pulse labelling during the earlier stage of the instar indicated the synthesis of a rapidly turning-over RNA having a base composition different from that of ribosomal RNA and resembling that of DNA. Sedimentation analysis of RNA at this stage revealed the presence of components having different sedimentation constants from those of the ribosomal and soluble RNA. At a later stage of the instar, there was no evidence for the occurrence of a rapidly turning-over RNA having a base composition different from that of ribosomal RNA. The role of RNA in silk fibroin synthesis is discussed. (CA 59: 1963, 11944d)

322 Keyl, H.-G., Pelling, C. DIFFERENTIELLE DNA-REPLIKATION IN DEN SPEICHELDRÜSEN-CHROMOSOMEN VON Chironomus thummi. (Differential DNA replication in the salivary-gland chromosomes of Chironomus thummi). Chromosoma 14 (1963) 347-59. (In German).

Bastard larvae from Ch. th. piper ♀ × Ch. th. thummi ♂ in late 4th instar or as prepupae were used. H^3-thymidine (specific activity 3.0 c/mM) and 2.C^{14}-thymidine (specific activity 26 mc/g), in aqueous isotonic maltose solution were injected into the haemolymph (0.25-1.0 µl). Various time intervals were allowed between injections. The course of DNA synthesis was followed autoradiographically and analyzed. DNA replication starts simultaneously in all transverse bands with a continuous thymidine uptake. In the final phase DNA synthesis can only be detected in the heterochromatic structures. All remaining transverse bands have completed DNA synthesis earlier, following a set sequence of events.

323 Krishnakumaran, A., Schneiderman, H.A. NUCLEIC ACID METABOLISM IN PUPAL TISSUES OF SATURNIID LEPIDOPTERA (Abstr. only). Amer. Zool. 3, 4 (1963) 298.

Ribonucleic acid and desoxyribonucleic acid metabolism of individual tissues in pupae of Hyalophora cecropia and Samia cynthia were studied at various stages using autoradiographic techniques. Cecropia has an obligatory pupal diapause and although DNA synthesis and cell division proceed vigorously in larvae and prepupae, pupation signals cessation of DNA synthesis in most tissues. Thus incorporation of thymidine stops in epidermis, muscles, fat body, tracheae, wing buds, malpighian tubules and gut. However, the brain synthesizes DNA for 5 d after pupation and haemocytes remain active throughout diapause. In contrast, some strains of Cynthia have no diapause; in such non-diapausing pupae DNA synthesis continues after pupation. Each tissue has its own programme of DNA synthesis during adult development; the epidermis is the first to synthesize DNA. Muscles and fat body follow. Thus in Cynthia there is no period of dormancy as marked by the inability of tissues to synthesize DNA. Analysis of ribonucleic acid metabolism of Cecropia pupae revealed that different tissues are "turned off" at different stages after pupation and that some remain active. Thus epidermis and the muscles of the anterior region continue RNA synthesis for only 2 d after pupation, while fat body and wing buds continue until about 10 d after pupation. In contrast, malpighian tubules, nervous tissue and haemocytes synthesize RNA at a significant rate throughout the pupal life. As might be expected all tissues of non-diapausing Cynthia synthesize RNA throughout the pupal stage.

324 Leach, W.M. THYMIDINE "POOL" IN GRASSHOPPER NEUROBLASTS. (Abstr.). ASB Bull. 10, 2 (1963) 32.

Embryos of the grasshopper (Chortophaga viridifasciata (De Geer) were incubated in tritiated thymidine (H^3T) and successively rinsed in 3 solutions. Observation of living neuroblasts and reidentification of the same cells in autoradiograms revealed that (1) corresponding portions of sister chromatids were labelled in the 1st division following incubation in H^3T; (2) some sister chromatids were labelled in complementary portions and some were labelled in corresponding portions in the 2nd division following incubation in H^3T; and (3) neuroblasts that were not in deoxyribonucleic acid (DNA) synthesis during incubation in H^3T incorporated H^3T into DNA during the succeeding DNA synthetic period. Results are interpreted as evidence of intracellular persistence of thymidine derivatives between periods of DNA synthesis.

325* Lima-de-Faria, A. INCORPORATION OF TRITIATED THYMIDINE INTO MEIOTIC CHROMOSOMES. Science 130 (1959) 503-4.

Grasshoppers (Melanoplus differentialis differentialis Thomas) were injected with tritiated thymidine (500 μc/ml), each animal receiving 0.02-0.04 ml. After 2-7 d the testes were fixed, squashed and Feulgen-stained. At pachytene, the sex chromosome in the spermatocyte forms a large block of heterochromatin which is quite distinct from the euchromatin of the autosomes. The hetero and euchromatin were found to synthesize DNA at a different time, the heterochromatin synthesizing DNA later.

326* Lima-de-Faria, A. DIFFERENTIAL UPTAKE OF TRITIATED THYMIDINE INTO HETERO- AND EUCHROMATIN IN Melanoplus AND Secale. J. biophys. biochem. Cytol. 6 (1959) 457-66.

Grasshoppers (M. differentialis) were injected with tritium-labelled thymidine. At intervals autoradiographic stripping film was applied over Feulgen squashes and sections. In this species during early prophase of meiosis the sex chromosome forms a heterochromatic block large enough to be resolved in H^3 autoradiographs. A study of the squash preparations reveals that the sex chromosome is synthesizing DNA at a different period of time from the euchromatic autosomes. Since there is a developmental sequence of spermatocyte cysts along the testicular tubes it is possible from the sections to show that the heterochromatin synthesizes DNA later than does the euchromatin. Corresponding studies were carried out on rye (Secale). The asynchrony of synthesis was found to occur within each chromosome in rye. Counts of Ag grains disclosed that the number of grains per unit area was 2-3 times higher over the heterochromatin. To check the DNA content, Feulgen photometric measurements were made of Melanoplus at nuclei at the same stage. The Feulgen and grain counts agree in showing that the heterochromatin contains 2-3 times more DNA per unit area than the euchromatin. (From auth.)

327 Lima-de-Faria, A. INITIATION OF DNA SYNTHESIS AT SPECIFIC SEGMENTS IN THE MEIOTIC CHROMOSOMES OF Melanoplus. Hereditas 47, 3-4 (1961) 674-94.

Autoradiographic stripping film was applied over Feulgen squashes and sections of spermatocytes of the grasshopper M. differentialis after an injection of tritiated thymidine into the body cavity. Testes were fixed 9-12 d following injection. In chromosomes at late pachytene the labelling was found to occur in clusters of Ag grains distributed along the entire length of the chromosome body at ca. 3 μ-intervals. As synthesis progresses the chromosomes get heavily labelled, and finally the number of grains taper off until synthesis ends. Measurements of the amount of DNA along the chromosome were made with a highly sensitive automatic recording microspectrophotometer, with a photocell aperture corresponding to 0.7 x 0.7 μ in the object plane. Absorption was measured along 1.3 μ-segments. The occurrence of grain clusters at 3 μ-intervals was not correlated with a higher DNA content of the chromosome segments involved. The initiation of DNA synthesis does not take place simultaneously along the whole meiotic chromosome, but rather occurs at specific segments. Crossing-over between genes may more easily take place at sites where DNA replication is initiated.

328 Lima-de-Faria, A. METABOLIC DNA (DEOXYRIBONUCLEIC ACID) IN Tipula oleracea. Chromosoma 13 (1962) 47-59. (In English).

In T. oleracea females a Feulgen positive body is present in the oögonia and oöcyte nuclei. By metaphase I the body is not seen. Injection of H^3-thymidine into the larvae leads to a heavy labelling of the Feulgen-positive body. The body is found to synthesize DNA at a different period of time from the chromosomes, and there is an intermediate period when the synthesis of the two nuclear structures overlaps. The H^3-thymidine is released from the body between the 3rd and 4th d of pupal life. At this time the yolk granules in the cytoplasm become particularly conspicuous. When the body disintegrates, the labelled material

becomes easily diluted. The volume of the nucleus and of the cytoplasm are sufficiently large to dilute this material in such a way that it becomes indistinguishable from background radiation. Spectrophotometric measurements of the body reveal that it contains 4 times more DNA per unit area than the chromosomes. The amount of DNA in the body is of a higher order of magnitude than that found in all the chromosomes. This large amount of DNA becomes suddenly available either to the chromosomes or other cellular components. DNA can carry its own genetic information to other cellular components. (CA 57: 1962, 11685i)

329 Lima-de-Faria, A., Nordqvist, T. DISINTEGRATION OF H^3-LABELED SPERMATOCYTES IN Melanoplus differentialis. Chromosoma 13 (1962) 60-6. (In English).

Whole cysts in the testicular tubes of M. differentialis disintegrate, giving rise to large Feulgen-positive bodies. The disintegration affects all the nuclei of a cyst. The Feulgen-positive bodies are strongly labelled with H^3-thymidine. Spectrophotometric measurements reveal that the bodies contain 3.5 times more deoxyribonucleic acid (DNA) per unit area than the autosomes of normal spermatocyte nuclei on an equal amount of DNA per unit area as the sex chromosome of the same nuclei. This regular disintegration of spermatocytes is not considered as a pathological condition but as an adaptation by which large amounts of DNA are easily released at a convenient time of development. (CA 57: 1962, 11685f)

330 Matsuzaki, K. THE INCORPORATION OF C^{14}-GLYCINE INTO THE SOLUBLE RIBONUCLEIC ACID (S-RNA) OF THE POSTERIOR SILK GLAND. J. Biochem., Tokyo 53 (1963) 326-7.

Posterior silk gland of Bombyx mori was homogenized, centrifuged (105 000 g, 2 h), the supernatant adjusted to pH 5, the precipitates chromatographed on a DEAE-cellulose column, and activating enzyme (I) eluted by 0.1-0.3 M KCl. I catalyzed incorporation of glycine-U-C^{14} (II) into aminoacyl-s-RNA in the presence of adenosine triphosphate, Mg and s-RNA. I was highly specific for II incorporation and did not incorporate any significant amount of leucine-1-C^{14} into s-RNA. Under similar conditions II was not appreciably incorporated into high-molecular weight (microsomal-?) RNA. (CA 59: 1963, 15650b)

331 Max-Planck-Institut für Biologie, Tübingen, Germany. ABTEILUNG BEERMANN (Pelling). Naturwissenschaften 49, 18 (1962) 560. (In German)

The incorporation of H^3-uridine as radiactive RNA-units into the Balbiani rings of the salivary gland chromosomes of Chironomus tentans may take place simultaneously with thymidine incorporation in DNA. Autoradiographs, however, indicate a drop in RNA synthesis during DNA replication so that the possibility of an interference of the two processes can not be excluded.

332 McMaster-Kaye, R. THE METABOLIC CHARACTERISTICS OF NUCLEOLAR, CHROMOSOMAL AND CYTOPLASMIC RIBONUCLEIC ACID OF Drosophila SALIVARY GLANDS. J. biophys. biochem. Cytol. 8, 2 (1960) 365-78.

Incorporation and retention of adenine-8-C^{14} and of $P^{32}O_4$ by nucleolar, chromosomal, and cytoplasmic RNA have been studied. Radioisotope concentrations were determined from autoradiographs, by grain counting, and RNA concentrations by microphotometry after basic staining. The relation between rates of RNA accumulation and rates of adenine incorporation was used to determine if synthesis was used to replace RNA which was lost from a fraction, and to obtain estimates of turnover rate. Nucleolar incorporation patterns indicate its incorporation is independent of growth, and there is complete turnover of the fraction in an hour or less. Nucleolar turnover is attributed to degradation of RNA within the nucleolus rather than to movement of intact molecules from the nucleolus. Chromosomal RNA reaches a much lower maximum specific activity than nucleolar, and a slightly higher maximum than cytoplasmic RNA. It showed faster incorporation than cytoplasmic RNA while accumulating RNA at the same rate as the cytoplasm, suggesting chromosomal RNA turnover. No evidence of cytoplasmic RNA turnover was found: rate of incorporation and rate of growth were correlated, and retention studies detected no decrease in amount of RNA-C^{14}, RNA-P^{32}, or RNA. Different ultimate precursors are indicated for nucleolar and non-nucleolar RNA by the observation that the nucleolar precursor is labelled before the precursor of non-nucleolar RNA. (Auth.)

333 McMaster-Kaye, R.D. SYMPOSIUM: SYNTHETIC PROCESSES IN THE CELL NUCLEUS. III. THE METABOLISM OF NUCLEAR RIBONUCLEIC ACID IN SALIVARY GLANDS OF Drosophila repleta. J. Histochem. Cytochem. 10 (1962) 154-61.

In 2nd day larvae salivary gland nucleoli reached maximum incorporation of P^{32} into RNA in 2 h and then lost 20% of activity/h. Chromatin and cytoplasmic RNA reached maximum in 8 h. (CA 56: 1962, 14749g).

334 Mead, C.G. THE RELATIONSHIP OF DNA-ASSOCIATED RNA WITH EUCHROMATIC AND HETEROCHROMATIC DERIVED DNA OF Drosophila melanogaster. (Abstr.). Genetics 47, 8 (1962) 970.

In the process of isolating Drosophila DNA free of cytoplasmic RNA, a small fraction of RNA consistently is found associated with the DNA. The nature of this association between DNA and RNA and its relationship with euchromatic and heterochromatic derived nucleic acids has been investigated. The molar nucleotide ratio of the DNA-associated RNA is identical to that of the corresponding DNA (equating U with T) but different from that of the microsomal RNA. The ratio of the DNA to its associated RNA is found to be 2:1. The RNA is sensitive to both alkaline hydrolysis and ribonuclease digestion. A study of the rate of incorporation of P^{32} orthophosphate into the nucleic acids of 3rd instar larvae demonstrates that the DNA-associated RNA incorporates P at a much higher rate than the microsomal RNA. Ultracentrifugal studies demonstrate a marked increase in the sedimentation velocity of the associated DNA after removal of the RNA with ribonuclease. The melting temperature (T_m) of the associated DNA is increased as a result of ribonuclease digestion. These data are interpreted as evidence of a DNA-RNA complex. The RNA of this complex exhibits many of the properties of "messenger RNA". Samples of these nucleic acid fractions derived from adult males that were coisogenic except for the presence or absence of a Y chromosome have also been examined. The DNA-associated RNA from XO and XY males exhibit molar nucleotide ratios which are identical. The major difference resulting from the addition of the Y chromosome to the genome appears to be that of a 5-10% increase in the amount of DNA as compared to the associated RNA. The simplest interpretation of the data is that heterochromatic DNA such as that derived from the Y chromosome of Drosophila does not contain an associated RNA.

335 Mead, C.G. A DNA-ASSOCIATED RNA FROM Drosophila melanogaster. (Abstr. D1C965). p.105 in "Research and Development in Progress, Biology and Medicine, Issue No.2". TID-4201, Division of Technical Information, AEC, Nov. 1963.

A DNA-associated RNA has been isolated and purified from adult Drosophila extracts. Several of the properties exhibited by this RNA are consistent with those postulated for an RNA serving as intermediate in the transfer of genetic information. The ratio of DNA:RNA was ~2:1 on a molar nucleotide basis. The molar nucleotide composition of the RNA was similar to that of DNA (equating U with T) and distinct from that of microsomal RNA or soluble RNA. Treatment with RNase, DNase, or by heat denaturation altered the sedimentation properties of the DNA-RNA complex. The T_M of the DNA, however, was only slightly increased (2°C) after removal of the RNA with RNase. The RNA associated with the DNA of 3rd instar larvae was found to be highly metabolically active with respect to P^{32} incorporation. Two types of RNA were distinguished by their relative metabolic stabilities, both of which were associated with the DNA.

336 Noguchi, T., Shigematsu, A., Igarashi, Y. STUDIES ON THE MODE OF ACARICIDAL ACTION. TRACING S-35 AND P-32 ELEMENTS INCORPORATED INTO ORGANISMS in vivo. p. B-9 in "The 4th Japan Conference on Radioisotopes - October 1961". Tokyo, Japan Atomic Industrial Forum, Inc.

Microautoradiography and biochemical analysis were used for studying the effects of diphenyl sulfone, diphenyl carbinol, diphenyl sulfonate and others on metabolism. S^{35}-labelled compounds were synthesized and their metabolism, incorporation and distribution studied by autoradiography. Their effects on phosphorus metabolism was determined biochemically for the silkworm and Acarina in terms of the turnover rate of P^{32}. The results show that the chemicals reduce the turnover rate of the intermediary metabolites of phosphorus, especially RNA and the acid-soluble fractions. They may therefore inhibit the biosynthesis of protein.

337 Pelling, C. APPLICATION OF TRITIATED COMPOUNDS TO THE MIDGE Chironomus AND SOME ASPECTS OF THE METABOLISM OF SALIVARY GLAND CHROMOSOMES. p.327-34 in "Tritium in the Physical and Biological Sciences, Vol.II. Proceedings of a Symposium, Vienna, 3-10 May 1961". Vienna, International Atomic Energy Agency, 1962.

The investigations were carried out on the salivary gland chromosomes of Chironomus tentans. Tritiated compounds (H^3-thymidine, H^3-uridine, H^3-amino-acids), injected into the haemolymph of the larvae should indicate the place of incorporation within the giant chromosomes. After fixation of the salivary glands autoradiographs of the squash-preparations were made. The autoradiographs show that giant chromosomes are most suitable for localizing the activity at chromosomal structures with high resolution. DNA-synthesis (thymidine), RNA-synthesis (uridine) and protein-synthesis within the cell could be followed by determining the time and, approximately, the quantity of incorporation: contrary to the protein-

synthesis, the DNA-synthesis and the RNA-synthesis are restricted to the chromosomes. The essential physiological activity of the chromosomes seems to be represented by RNA synthesis which takes place at certain distinct loci (nucleolar organizers, "Balbiani-rings", puffs, and other chromosomal bands). The report discusses some features of RNA synthesis. (From auth.)

338 Plaut, W. ON THE REPLICATIVE ORGANIZATION OF DNA IN THE POLYTENE CHROMOSOME OF Drosophila melanogaster. J. Molecular Biol. 7, 6 (1963) 632-5.

Salivary glands were dissected from larvae of various stages of maturation and incubated, in vitro in a medium also containing tritiated thymidine. The appearance of discrete labelling sites on autoradiographic preparations of pulse-labelled Drosophila salivary gland chromosomes indicates the presence of several independent points of DNA synthesis along the length of these polytene structures. While subject to an alternative interpretation, the data are most simply reconciled with the presence of several molecular ends in the DNA complement along the axis of each chromosome arm. (Auth.)

339 Sengün, A. INCORPORATION OF TRITIATED THYMIDINE INTO THE GIANT CHROMOSOMES OF Chironomus plumosus (Tendipes plumosus) LARVAE. Path. Biol. Sem. Hôp. 9 (1961) 753-5. (In English).

Larvae of Chironomus were placed in solutions containing H^3-thymidine or injected with small quantities of the solution. The salivary glands and Malpighian tubules were dissected, fixed in acetic acid-alcohol and autoradiographs prepared with stripping film. Labelling of the nuclei of the cells occurred sporadically in both tissues. In some of the nuclei the chromosomes were labelled approximately in accordance with the amount of DNA in the various parts. However, in many nuclei only parts of the chromosome complement incorporated the label. These parts were either large sectors of a few chromosomes, many different bands or groups of bands; or in some instances very small regions of one or a few bands to which the label was restricted. The observations can be accounted for by asynchronous duplication of the various regions of the chromosomes. However, the lack of any uniform pattern of incorporation among the cells of a gland appears to be incompatible with suggestions of a special functional significance to the synthesis of DNA at loci in giant chromosomes. (Auth. summary).

340 Sengün, A. EXISTENCE OF TWO KINDS OF DEOXYRIBONUCLEIC ACID (DNA) AND CHROMOSOMAL SECRETION AS DEMONSTRATED BY MEANS OF AUTORADIOGRAPHY USING TRITIATED THYMIDINE. Path. Biol. Sem. Hôp. 10 (1962) 1701-5.

By Feulgen staining and autoradiography of the giant chromosomes of Tendipes plumosus, evidence was obtained for 2 kinds of DNA. One kind is associated with the hereditary units (chromonemata) and the other is extrachromosomal. The 2nd type may be found in the nucleoplasm surrounding the chromosomes and in some cases appears to be extruded from the nucleus into cytoplasm. The extrachromosomal DNA does not appear to be associated with any particular structural unit, as seen by electron microscopy of autoradiographs. (CA 58: 1963, 11727g)

341 Sengün, A. THE INCORPORATION OF H^3-THYMIDINE INTO THE HOMOLOGOUS GIANT CHROMOSOMES OF Simulium LARVAE. Rev. Fac. Sci. Univ. Istanbul, Ser. B. 27, 2-3 (1962) 129-35.

The larvae were exposed for 3 h and 6 h to H^3-thymidine (specific activity 1.9 mc/mM; 60 μc in 10 ml of tap water). The synapsis of the salivary-gland chromosomes of Simulium larvae is incomplete at some points although the disc pattern on each homologous chromosome in regions where they are lying side by side appears the same. In linear as well as lateral patterns of organization the different parts of a chromosome exhibit autonomous behaviour in DNA synthesis. Where a gap in synapsis exists (i.e. where the pairing of the 2 homologous chromosomes is incomplete) each homologous part incorporates H^3-thymidine independently so that in some cases the homologous regions of the homologous chromosomes united in one giant chromosome show differences autoradiographically, which may help in investigations into the activity of allele genes combined in one giant chromosome.

342 Sengün, A., Özalpan, A., Anil, D., Üçer, E. THE OCCURRENCE OF METABOLIC DEOXYRIBONUCLEIC ACID IN GIANT CHROMOSOMES. Rev. Fac. Sci. Univ. Istanbul, Ser. B. 27, 2-3 (1962) 151-64.

The salivary-gland chromosomes of dipterous larvae (at any rate, of Drosophila melanogaster and Chironomus plumosus) reach their final stage of development in the prepupal stage. Multiplication of chromonemata of the giant chromosomes does not occur in pupae. On the contrary, their size is reduced and their disc pattern becomes invisible. An attempt has been made to incorporate H^3-thymidine into the salivary-gland

chromosomes of pupae, to see whether DNA synthesis occurs in those chromosomes which are already in a state of being digested and no longer multiply. H^3-thymidine was injected into pupae 18, 22, 23, 24, 25, 26, and 27 h old. While some regions were highly radioactive other parts of the same chromosome would not incorporate the label. It appears that some regions of the chromosomes are still capable of incorporating H^3-thymidine and of synthesizing DNA during their digestion in pupae; DNA synthesis is thus apparently not related to multiplication of chromonemata.

343 Sengün, A. STRUCTURE AND FUNCTION OF THE GIANT CHROMOSOMES. Rev. Fac. Sci. Univ. Istanbul, Ser. B 27, 3-4 (1962).

It was demonstrated by means of radioisotopes that the physiological condition of a giant chromosome along its length is not the same and that the uptake of such substances as H^3-thymidine, H^3-adenine, P^{32}, S^{35}, etc. varies from region to region of the same chromosome; from chromosome to chromosome in the same nucleus; in a comparison of homologous chromosomes, from nucleus to nucleus in the same tissue; from tissue to tissue in the same larva; and from larva to larva, even when of the same age. Each homologue appears to be acting as a physiological unit in the lateral organization whereas the activity of each daughter chromatid is generally masked for they have the same gene loci. Different degrees of incorporation of labelled substance may sometimes be correlated with morphologically distinct parts of the chromosome such as the heterochromatic and the euchromatic regions. Cytological studies have shown bands to secrete DNA.

344 Sengün, A. STRUCTURE AND FUNCTION OF THE GIANT CHROMOSOMES. (Abstr.). p.278 in "XVI International Congress of Zoology, Washington, 20-27 August 1963. Vol.II". Moore, J.A., Ed. Washington D.C., XVI International Congress of Zoology.

See 343.

345* Séréno, C., Durand, M. INCORPORATION OF TRITIATED ADENOSINE IN THE OVARY OF THE CRICKET (Gryllus bimaculatus). C.R. Acad. Sci., Paris 251 (1960) 2242-4.

Radiographic study of nucleic acids isolated from the ovary after injection of tritiated adenosine in the female cricket shows that the precursors of ribonucleic acid (I) accumulate in the ovary prior to synthesis, that cytoplasmic I is rapidly synthesized during active protein synthesis, and that there is an accumulation of I in the cytoplasm of the oöcyte when deoxyribonucleic acid levels are elevated. (CA 55: 1961, 14734d)

346 Séréno, C., Durand, M. INCORPORATION OF TRITIATED URIDINE INTO CRICKET OVARIES. C.R. Acad. Sci., Paris 253 (1961) 734-9.

Uridine-H^3 was injected into the abdominal cavities of adult female crickets (Gryllus bimaculatus). The gonads were removed after 24 h and examined histologically and autoradiographically. In follicular cells uridine was incorporated more rapidly into ribonucleic acid (I) than into deoxyribonucleic acid. In ovocytes labelling was almost entirely restricted to RNA. (CA 56: 1962, 5233b)

347* Sirlin, J.L. CELL SITES OF RNA AND PROTEIN SYNTHESES IN THE SALIVARY GLAND OF Smittia (CHIRONOMIDAE). Exp. Cell Res. 19 (1960) 177-80.

Early prepupae of Smittia sp. were injected ventrally in the 2nd (wing) segment, where the greater part of the salivary glands is contained, with ~0.015 μc (0.015 mm^3) tritiated uridine, leucine or thymidine. (Uridine, nominally 5,6-H^3; DL-leucine-H^3, general label; thymidine, probably 6-H^3; with specific activities of 63, 102.2 and 360 mc/mM, respectively). Their uptake by salivary gland cell components is described and some of the implications mentioned. Intense local protein synthesis in cytoplasm has been observed.

348* Sirlin, J.L., Jacob, J. CELL FUNCTION IN THE OVARY OF Drosophila. II. BEHAVIOR OF RIBONUCLEIC ACID (RNA). Exp. Cell Res. 20 (1960) 283-93.

Female D. melanogaster were fed for 3 h on food containing orotic acid-6-C^{14}, for 0-8 h on food with non-radioactive orotic acid. Autoradiographic scoring of the tracer in ovarian nurse cells, oöcytes, and follicle cells showed that ribonucleic acid (RNA) function is intense at the point of contact of RNA masses with chromatin. (CA 55: 1961, 23847c)

349 Sirlin, J.L., Kato, K.-I., Jones, K.W. SYNTHESIS OF RIBONUCLEIC ACID (RNA) IN THE NUCLEOLUS. Biochim. biophys. Acta 48 (1961) 421-3.

An important amount of nuclear RNA is turned over in the nucleolus, the greatest nucleolar turnover being at the core contiguous with the chromosomal nucleolus organizer. The nature of this RNA was studied by measuring the uptake of H^3-labelled nucleosides by nucleoli, chromosomes, Balbiani ring, and cytoplasm of salivary glands of the chironomid Smittia at different stages of larval growth. The pattern of pseudouridine uptake differed from that of the other ribonucleosides. The data indicated the synthesis in situ of nucleolar RNA, and suggested that at least part was transfer RNA up to stage III of development. (CA 55: 1961, 25070i)

350 Sirlin, J.L., Jacob, J., Kato, K.-I. THE RELATION OF MESSENGER TO NUCLEOLAR RNA. Exp. Cell Res. 27 (1962) 355-9.

Nuclei in situ in salivary glands of fully grown larvae (stage IV) of Smittia sp. (Chironomidae) were pretreated with inhibitors [actinomycin C (Bayer), TRB (4,5, 6(5,6,7)-trichloro-1-β-D-ribofuranosyl)-benzimidazole; ex K. Folkers), and thioacetamide), followed by exposure to H^3-uridine (30 μc/cc). The three classes of inhibited nuclei produced by actinomycin C and TRB, and the two classes produced by thioacetamide are described. Nucleolar RNA has a vectorial turnover with the dense-particulate part at the origin determining either a centrifugal or centripetal stable pattern. The centrifugal turnover pattern used in this work lends itself to inhibition studies. The studies indicate an extrinsic and an intrinsic nucleolar RNA, the former being chromosomal messenger RNA. Messenger RNA, and not organizer DNA, primes intrinsic nucleolar RNA. Free messenger was directly observed in the nucleus and followed to cytoplasm.

351 Sirlin, J.L., Schor, N.A. MACROMOLECULAR SYNTHESES IN ISOLATED POLYTENE NUCLEI. Exp. Cell Res. 27, 1 (1962) 165-7.

Basal salivary-gland nuclei of the sciarid, Rhynchosciara angelae, were isolated (by hand) and cultured in a standard medium (Proc. Natl Acad. Sci. 46: 1960, 432), at room temperature, with or without polyvinylpyrollidone, at an empirical 2.8% concentration (PVP-medium). Isolated nuclei were cultured with tritiated guanosine, cytidine or leucine added at 40-150 μc/cc, for 30-90 min. In some experiments the nuclei were precultured in the presence of inhibitors added to the media and then micropipetted into the radioactive medium, or these compounds were offered together with tracer. The processing for autoradiography is described. Non-isolated nuclei in the cultured twin gland were the controls. Incorporation by the glands appears the same in vitro as in vivo. Isolated nuclei and controls have a similar pattern of nucleoside incorporation but differ for amino acid (leucine). Uptake of nucleosides in isolated nuclei is greater in micronucleoli and unorganized nucleolar masses than in chromosomes (puffs excepted). Incorporation of guanosine is reduced by pre-treatment with 4,5,6-trichlororibofuranosylbenzimidazole (0.05 mg/cc) or co-treatment with actinomycin (0.035 mg/cc). Uptake of leucine in non-isolated nuclei, presumably in protein, is slightly greater in nucleolar material than in chromosomes, the reverse applying for isolated nuclei. Co-treatment with puromycin (0.33 mg/cc) seemingly inhibits incorporation.

352 Sirlin, J.L., Schor, N.A. FURTHER OBSERVATIONS ON ISOLATED POLYTENE NUCLEI. Exp. Cell Res. 27, 2 (1962) 363-6.

Chase experiments were performed on nuclei of Rhynchosciara angelae pre-incubated with tritiated guanosine (0.2 mM) in 2.8% polyvinylpyrrollidone (PVP) medium for 30 min. The nuclei were then incubated for 3 h in 3 alternative media with 10-fold excess adenosine and guanosine added: (1) standard medium, (2) PVP-medium, and (3) PVP-medium with 0.2 mM 2-3-dinitrophenol (DNP). In (2) a loss of ¼ - ½ of their RNA label in chromosomes and nucleolar material was observed, compared with controls. DNP slightly inhibited loss. Pretreatment of nuclei with dilute acetate buffer (pH 4.5) in (1) lowered the subsequent uptake of cytidine or guanosine offered in (2), and chromosomes were damaged. When both buffer and tracer were each offered in (2) the incorporation of leucine mainly into protein was not inhibited. Pretreatment with DNP or ethydium bromide (20 μc/cc) had no effect on cytidine uptake when PVP was present throughout incubation. Co-treatment with 5-fluorouridine (1.5 mM) inhibited uridine uptake, preventing the formation of nucleolar material in the chromosomes. This suggests adulteration of RNA through competitive uptake between analogue and nucleoside, which is supported by the actual incorporation of 5-fluorouracil-2-C^{14}. PVP was found to protect against uptake inhibition and to promote release of nuclear RNA when present throughout all incubation steps. Pseudouridine C (7.5-fold excess; ex W.E. Cohn) when offered simultaneously with tritiated uridine had no effect on uptake. The absence of

organizer results in a peripherally disposed denser-particulate nucleolar region which determines a directional (centriperal) pattern of nucleolar RNA turnover with its origin in that region.

353 Sirlin, J.L. THE NUCLEOLUS. p. 25-66 in "Progress in Biophysics and Biophysical Chemistry. Vol. XII". Butler, J.A.V., Huxley, H.E., Zirkle, R.E., Eds. Oxford, Pergamon Press. 1962.

Comprehensive review article, divided into parts on the biology of the nucleolus (physical aspects, studied microscopically and submicroscopically: nucleolus, nucleolus organizer, nucleolus-associated chromatin; physico-chemical and chemical aspects: RNA, DNA, proteins, enzymes, lipids, carbohydrates, minerals; physiology: status of cell, nutrition, turnover; pathological and experimental alterations; behaviour during mitosis: and mode of formation) and its function in terms of enzymes, RNA, transfer RNA, template RNA, the nucleolar organizer, proteins, ribosomal proteins and spindle proteins. - Tracer studies (p. 39-42, also figs. 1, 2) have proved particularly useful in RNA turnover studies (nuclear and nucleolar RNA, and interphase nucleolar RNA). - References: p. 59-66, the present bibliography being only concerned with a few of these.

354 Sirlin, J.L. ADDENDUM TO "THE NUCLEOLUS". p. 319-26 in "Progress in Biophysics and Biophysical Chemistry. Vol. XII". Butler, J.A.V., Huxley, H.E., Zirkle, R.E., Eds. Oxford, Pergamon Press. 1962.

Further sections deal with morphology, tumours, nucleolus-associated chromatin, and biochemical and mechanical aspects of the nucleolus. An extensive bibliography is given.

355 Sirlin, J.L., Tandler, C.J., Jacob, J. THE RELATIONSHIP BETWEEN THE NUCLEOLUS ORGANIZER AND NUCLEOLAR RNA. Exp. Cell Res. 31 (1963) 611-5.

Salivary glands from larvae of Smittia parthenogenetica in stage III were incubated in vitro under a variety of conditions: with tritiated thymidine; with tritiated thymidine and actinomycin D; in the presence of proflavine in the dark, with tritiated uridine added at one stage. The incorporation of thymidine into DNA in the chromosomes (including the organizer) was very strong, while no incorporation was shown by nucleoli except rarely. Proflavine totally inhibited nucleolar RNA synthesis and only partially inhibited chromosomal RNA. The organizer incorporated uridine to about the same concentration as the other chromosome regions. Actinomycin inhibited the incorporation of uridine into nuclear RNAs as described for proflavine. These inhibitions were also observed with tritiated guanosine. The synthesis of nucleolar RNA (Smittia) appears to begin in the nucleolus proper and is dissociable from the synthesis in the organizer, a conclusion which may be generally valid. Whatever relationship exists between nucleolar RNA and organizer DNA it is not different from that which exists between nucleolar RNA and other (not necessarily all) chromosomal DNA.

356 Sirlin, J.L., Jacob, J., Tandler, C.J. TRANSFER OF [^{14}C-METHYL] METHIONINE TO NUCLEOLAR RIBONUCLEIC ACID. Biochem. J. 87 (1963) 37P.

Salivary glands of the chironomid Smittia were cultured in vitro in a synthetic medium containing S^{35}- or generally H^3-labelled methionine. Results showed that, in contrast to the incorporation of C^{14}, the incorporation of these tracers into the nucleolus was inhibited by puromycin. Ethionine competitively inhibited the nucleolar uptake of [C^{14}-methyl] methionine in the presence of puromycin, which confirms that methionine is a methyl donor. The methylated bases are characteristic of transfer RNA, as previously suggested from the incorporation of pseudouridine (see 349).

357 Steffensen, D.M. EVIDENCE FOR THE APPARENT ABSENCE OF DNA IN THE INTERBANDS OF Drosophila SALIVARY CHROMOSOMES. Genetics 48, 10 (1963) 1289-1301.

Drosophila salivary chromosomes were labelled with thymidine-H^3. Distribution of radioactive DNA (deoxyribonucleic acid) was studied by quantitative autoradiography. Stretched chromosomes were examined for the distribution of radioactivity from tritium β-particles over bands and interbands (in overlying Ag halide emulsion). More radioactivity was found in the bands than in the interbands. The level of radioactivity in the interbands did not exceed background count in the nucleoplasm. The majority of evidence indicated that DNA was not present in the interbands. (CA 60: 1964, 8391e)

358 Tandler, C.J., Sirlin, J.L. NUCLEAR POOL OF RIBONUCLEIC ACID (RNA) PHOSPHORUS. Biochim. biophys. Acta 55 (1962) 228-30. (In English).

The pattern of incorporation of $P^{32}O_4^{---}$, cytidine-H^3, and guanosine-H^3 was examined in cells of onion and broad-bean rootlets and salivary glands of the chironomid Smittia. The former 2 types of cells showed

heavy labelling of nucleolus RNA when nucleoside-H^3 was added, while nucleolus RNA was relatively inert with respect to P^{32}. Frequently a ring of chromatin surrounding the nucleolus showed marked incorporation of P^{32}. A sluggish nucleolar P^{32} turnover was also observed in Smittia. (CA 56: 1962, 13223h)

359 Vanderberg, J.P. SYNTHESIS AND TRANSFER OF DNA (DEOXYRIBONUCLEIC ACID), RNA (RIBONUCLEIC ACID), AND PROTEIN DURING VITELLOGENESIS IN Rhodnius prolixus (HEMIPTERA). Biol. Bull 125, 3 (1963) 556-75.

Histochemical and autoradiographic techniques demonstrated that DNA was synthesized in the nuclei of the ovary, fat body, and midgut. There appeared to be a transfer of some of the DNA in a partially depolymerized form from the ovarian trophic tissues to the growing oöcyte. RNA was synthesized in the nuclei of the ovary, fat body, and midgut, and then was transferred to the cytoplasm. Some of the RNA passed from the ovarian trophic tissues to the growing oöcyte. Protein was synthesized most actively in the ovarian follicular epithelium, and in the fat body. Newly synthesized protein was transferred from the follicular epithelium to the oöcyte. Synthesis of yolk protein by the oöcyte itself appeared to be negligible. (Auth.)

360 Watkins, M.J. INTERFEROMETRIC AND AUTORADIOGRAPHIC STUDIES OF GRASSHOPPER CHROMOSOMES. Summer Meeting of American Society of Zoologists, Oregon State University, Corvallis, Oregon, August 1962. Amer. Zool. 2, 3 (1962) 457.

361 Woods, P.S., Gay, H., Sengün, A. ORGANIZATION OF THE SALIVARY-GLAND CHROMOSOME AS REVEALED BY THE PATTERN OF INCORPORATION OF H^3-THYMIDINE. Proc. nat. Acad. Sci., Wash. 47, 9 (1961) 1486-93.

H^3-thymidine was incorporated in young larvae of Drosophila melanogaster by placing them for varying periods in a medium consisting of 0.63 g of standard cornmeal-molasses-agar mixture, 0.08 g of yeast and 28.4 µg of H^3-thymidine, with a specific activity of 244 mc/mM in one series of experiments and 1600 mc/mM in another. Autoradiography was used, also phase contrast microscopy for fine structure, particularly of the interband regions. Findings on the lateral and linear patterns of organization in fully developed chromosomes of the salivary gland are consistent with the view that (1) DNA occurs as a unit which traverses the bands and extends along the full length of the chromosome; (2) the unit occupies only a small part of the cross-sectional area of the chromosome and therefore constitutes a single strand among many; (3) this entity remains intact during succeeding replication (except for possible interstrand exchanges); and (4) DNA may not be distributed uniformly along the strands, because radioactivity appears to be concentrated primarily in regions that correspond to the bands.

362* Zalokar, M. SITES OF RIBONUCLEIC ACID AND PROTEIN SYNTHESIS IN Drosophila. Exp. Cell Res. 19 (1960) 184-6.

Precursors for proteins (DL-leucine-4,5-H^3, 3570 mc/mM) and for ribonucleic acid (uridine-5,6-H^3, 640 mc/mM) were injected into adult, egg-laying Drosophila melanogaster. Similar experiments were made with larvae of the 3rd instar at the age of 1 d before metamorphosis. The technique is described. The occurrence of heavy incorporation of H^3-labelled leucine in the cytoplasm before noticeable incorporation in the nuclei indicated that cytoplasm is the main site of protein formation. The experiments give further support to the hypothesis of the nuclear origin of RNA.

363 Zalokar, M. RIBONUCLEIC ACID AND THE CONTROL OF CELLULAR PROCESSES. p.87-140 in "Control Mechanisms in Cellular Processes", Bonner, D.M., Ed. New York, The Ronald Press Company, 1961.

Comprehensive review article, including autoradiographic data obtained for Drosophila (p.91-4, 97, 107, 229), Blattella germanica (p.94-5), Chironomidae (p.94), Bombyx mori (p.125), and Malacosomma americana (p.107-8).

364 Zalokar, M. THE ROLE OF NUCLEOLUS IN THE PRODUCTION OF RIBONUCLEIC ACID. (Abstr.). Genetics 47, 8 (1962) 998.

The incorporation of H^3-uridine into RNA of oöcyte nuclei of Blattella germanica was studied by autoradiography. When oöcytes were incubated in H^3-uridine for four to 16 min, the newly formed, labelled RNA appeared in both nucleoli and chromosomes. Nucleolar RNA was first observed in several spots at the periphery of the nucleolus. After one hour or longer incubation the nucleolus became uniformly labelled. These observations indicate that nucleolar RNA was produced at the periphery of the nucleolus, where the presence of DNA could be demonstrated. It is probably not the nucleolus itself which produces nucleolar

RNA, but this DNA belonging to the chromosomal regions adjacent to the nucleolus. Experiments with Actinomycin D showed that this DNA is functionally different from DNA in the rest of chromosomes. When oöcytes were incubated in H^3-uridine in the presence of 2 µg/ml of Actinomycin D, nucleoli remained unlabelled, while chromosomes became labelled nearly as strongly as in the absence of the drug. At higher concentrations (10 µg/ml) Actinomycin D inhibited both nucleolar and chromosomal RNA production. In conclusion it appears that the nucleoli serve as intermediate storage or processing place for a certain kind of RNA, produced by particular regions of chromosomes. The problem of transfer of chromosomal and nucleolar RNA into the cytoplasm is now being studied by inhibiting new RNA formation with Actinomycin D.

See also:

151 Biochemistry of diapause, development, and injury in silkworm pupae. (Wyatt, 1963)
163 Transmission of phosphorus-32 incorporated by parents into descendants of Drosophila melanogaster. (Faludi et al., 1961)
185 Incorporation of P^{32} into the phosphorous compounds of the wax moth larvae. (Wlodawer, 1961)
211 Study on the biosynthesis of pterins in Drosophila melanogaster. (Brenner-Holzach and Leuthardt, 1959)
222 Synthesis and breakdown of proteins and ribonucleic acid in Tribolium confusum. (Devi et al., 1963)
293 Electron microscopic and some biochemical studies on the cell fractions of silkglands. (Suto and Shimura, 1961)
301 The role of the gonadotropic hormone in the synthesis of protein and RNA (ribonucleic acid) in Rhodnius prolixus. (Vanderberg, 1963)
418 Timing of spermatogenesis in Drosophila melanogaster using tritiated thymidine. (Chandley and Bateman, 1962)
419 An autoradiographic study of wound healing in diapausing silkworm pupae. (Davis and Schneiderman, 1960)
421 Nucleotides and other phosphorus compounds of cockroach nerve. (Heslop and Ray, 1961)
422 Nucleotides and other phosphorus compounds of the cockroach central nervous system. (Heslop and Ray, 1961)
426 Cell function in the ovary of Drosophila. I. Deoxyribonucleic acid (DNA) classes in nurse cell nuclei as determined by autoradiography. (Jacob and Sirlin, 1959)
442 Low incidence of polyspermy in Drosophila melanogaster and Drosophila virilis. (Hildreth and Lucchesi, 1962)
443 Fertilization in Drosophila. I. Evidence for the regular occurrence of monospermy. (Hildreth and Lucchesi, 1963)
475 The genetic effects of labelled DNA precursors. (Kaplan et al., 1963)
477 Mutagenic effect of C^{14} and H^3 labelled DNA precursors injected into Drosophila melanogaster males. (Strömnaes, 1962)
985 Chromosome splitting as revealed by combined X-ray and labelling experiments. (Wolff, 1963)
1191 X-ray induced incorporation of tritiated thymidine into grasshopper neuroblast chromosomes. (McGrath, 1963)
1192 X-ray-induced incorporation of tritiated thymidine into deoxyribonucleic acid of grasshopper neuroblast chromosomes. (McGrath, 1963)
1544 Progress in tritium autoradiography. (Lima-de-Faria, 1962)

I-B-6 LIPIDS, STEROL AND STEROID METABOLISM

365* Agarwal, H.C., Casida, J.E. NATURE OF HOUSEFLY STEROLS. Biochem. biophys. Res. Commun. 3 (1960) 508-12.

Sterols were extracted from Musca domestica and purified by digitonin precipitation and chromatography in a silicic acid-celite column with a gradient of Skellysolve C and benzene for elution. Three sterols were recovered from adults and eggs and 4 from larvae and pupal exuviae. The major sterol appeared to be the same in each case. The major sterol, designated muscasterol (I), differs from cholesterol only in the side chain where the isopropyl structure is missing. The side chain of I (starting at C-24) appears to be either $-CH(C_2H_5)_2$ of the α or β form of $-CH(CH_3)C_2H_5$. There was little or no conversion of cholesterol to I when eggs were incubated in a medium containing C^{14}-labelled cholesterol acetate. (CA 55: 1961, 16838f).

366 Agarwal, H.C., Casida, J.E., Beck, S.D. AN UNUSUAL STEROL FROM HOUSEFLIES. J. Insect Physiol. 7 (1961) 32-45.

Sterols (I) were extracted from whole adult Musca domestica and their pupal exuviae. The I were separated into fractions by chromatography, and individual I were identified by chemical and physical means including optical rotations, x-ray diffraction patterns, and infra-red and nuclear magnetic resonance spectra. The major sterol, muscasterol (II), was present throughout the life cycle. Extensive data are given on II whose structure is only partly elucidated. II has many similarities to cholesterol but probably differs in the position of substituents in the saturated side-chain. In metabolic tests, no cholesterol-4-C^{14} appeared to be incorporated into II. The precursor of II may have been a phytosterol supplied in the food. A compound similar to methostenol was found in the larvae and papal exuviae, but it was not detected in the eggs or the adults. 2 minor sterols (A and B) were eluted from silicic acid-celite columns in the positions of Δ^7-cholestenol and 7-dehydrocholesterol, respectively. Sterol A appeared to be mainly a Δ^7-sterol and sterol B, a $\Delta^{5,7}$-sterol. (CA 57: 1963, 5132f).

367 Agarwal, H.C. STUDIES ON HOUSE FLY STEROLS AND CHOLESTEROL-C^{14} METABOLISM IN HOUSE FLIES AND COCKROACHES. Thesis, Wisconsin, Univ., Madison, 1961.

The nature of the sterols present in the various developmental stages of Musca domestica was investigated. The in vivo esterification of cholesterol-4-C^{14} and hydrolysis of cholesteryl-4-C^{14} acetate in M. domestica L. and Periplaneta americana (L.) were studied. Hydrolysis was more rapid than esterification, and the roach more active than the fly in this respect. In both cases a "cholesterol-like" sterol, more polar steroids and a steryl ester less polar than cholesteryl acetate were recovered. The in vivo balance of sterol and its esters was found to be disturbed by thiocholesterol and DDT (2,2-bis-(p-chlorophenyl)-1, 1,1-trichloroethane). Metabolism of cholesteryl-4-C^{14} acetate was studied in a complete life cycle of the housefly. A preponderance of polar C^{14}-labelled steroids was formed in the eggs, larvae, pupal exuviae and adults. Nymphs of P. americana were similarly studied. The major sterol was again not cholesterol but was slightly less polar. In contrast to the fly, however, the nymph major sterol appeared to be formed from cholesterol. Other sterols behaved similar to Δ^7-cholesterol and possibly 7-dehydrocholesterol in chromatography and the Liebermann-Burchard reaction. A last chromatographic fraction representing both natural and C^{14} materials consisted of more polar steroids. It appears that roaches convert cholesterol into their major sterols, more polar steroids, and a "coprosterol-like" sterol which is excreted in the faeces.

368 Bade, M.L., Clayton, R.B. CHOLESTEROL ESTERS OF THE COCKROACH Eurycotis floridana. Nature, Lond. 197 (1963) 77-9.

Cockroaches were fed a series of diets containing 4-C^{14}-cholesterol. A general procedure for the isolation of cockroach sterol esters is described and the results are tabulated. The major sterol ester of E. floridana reared on diet 1 is cholesterol oleate. (Diet 1 consisted of the semi-synthetic diet of Noland and Baumann, cf. Proc. Soc. exp. Biol., N.Y. 70: 1949, 198, in which the corn oil had been replaced by commercial sodium oleate; it also contained, in addition, 0.1% 4-C^{14}-cholesterol). The remaining sterol esters appear to consist principally of linoleate and a small saturated ester fraction in which palmitate is the principal component.

369 Bridges, R.G., Crone, H.D., Beard, J.R. A STUDY OF THE PHOSPHOLIPIDS OF DIELDRIN-RESISTANT AND SUSCEPTIBLE HOUSEFLIES, WITH PARTICULAR REFERENCE TO THOSE OF THE THORACIC GANGLION. p.145-52 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960", Vienna, International Atomic Energy Agency. 1962.

A study of housefly phospholipids was made because of the possibility that some alteration in membrane structure or active transport is implicated in the mechanism of dieldrin-resistance in insects. The phospholipids of a dieldrin-resistant strain of housefly and of a susceptible strain from which it was derived were labelled by feeding the flies on P^{32}-labelled orthophosphate solution for 24 h and then allowing them to metabolize the adsorbed P^{32}-phosphate for periods up to 336 h. Thoracic ganglia were removed and the phospholipids separated by chromatography on silicic acid impregnated paper strips. Four major phospholipid fractions can be separated which appear to be the same as those obtained from extracts of whole flies. In the case of whole fly extracts the identity of the fractions is as follows: fraction II phosphatidyl inositol, fraction III lysocephalin, fraction IV a mixture of phosphatidyl choline and an unidentified phospholipid, and fraction V phosphatidyl ethanolamine and phosphatidyl serine. Fraction I consists of non-phospholipid phosphorus-containing compounds. Maximum labelling of the fractions was obtained after feeding the flies (on glucose and water) for one week after removal from the P^{32}-phosphate. The distribution of the P^{32}-activity in the separated fractions from the ganglia of the resistant and susceptible fly showed no significant

differences at the time of maximum labelling. There was, however, some evidence for a slower turnover of P^{32}-activity into the two major phospholipid fractions (IV and V) from the resistant fly. This was made more obvious when the flies were fed on milk in addition to glucose and water. Preliminary studies on turnover for much shorter periods were carried out on phospholipid extracts from whole flies injected with P^{32}-labelled orthophosphate solution. These showed a more rapid turnover of P^{32}-activity into the phosphatidyl inositol fraction (II) in the case of the resistant flies, although in these short-term experiments there seems to be no difference in turnover into fractions IV and V from the two strains. The possible significance of the findings is discussed. (Auth.)

370 Chojnacki, T., Piechowska, M.J. BIOSYNTHESIS OF PHOSPHOLIPIDS IN INSECTS. I. INCORPORATION OF P^{32}-PHOSPHOCHOLINE INTO PHOSPHOLIPIDS OF Celerio euphorbiae. Acta biochim. polon. 8, 2 (1961) 157-65. (In Polish, with English and Russian summaries).

A molecule of phosphocholine takes part in biosynthesis of lecithin in Celerio euphorbiae. The rate of incorporation of P^{32}-phosphocholine when followed in homogenates of fat-body is not equal in various stages of the insect growth. It is the highest in caterpillars, while it is a slight one only in spindle, pupa and moth. The incorporation of injected labelled phosphocholine into phospholipids, when observed in vivo, is also in moth 1/3 of that in feeding caterpillars. (Auth.)

371 Chojnacki, T. BIOSYNTHESIS OF PHOSPHOLIPIDS IN INSECTS. II. STUDIES ON INCORPORATION OF P^{32}-ORTHOPHOSPHATE IN Celerio euphorbiae moth. Acta biochim. polon. 8, 2 (1961) 167-75. (In Polish, with English and Russian summaries).

The course of incorporation of P^{32} into phospholipids of the Celerio euphorbiae male moth was investigated. Maximal specific activity of phospholipid fraction was found about 12 h after injection of labelled orthophosphate. Cephalins showed higher rate of regeneration than lecithins did. Cephalins reached their maximal specific activity within 12 h after isotope had been administered while lecithins after 36 h only. The course of incorporation of P^{32} into phosphocholine indicated that phosphocholine might be a precursor of lecithin. The biosynthesis of lecithin in Celerio euphorbiae male moth has been discussed in relation to the storage of pyrophosphate in his ductus ejaculatorius and it has been concluded that the process of local accumulation of pyrophosphate did not run in parallel with the rate of biosynthesis of lecithin in whole body. (Auth.)

372 Chojnacki, T., Korzybski, T. BIOSYNTHESIS OF PHOSPHOLIPIDS IN INSECTS. III. THE INCORPORATION OF (P^{32}) ORTHOPHOSPHATE INTO PHOSPHOLIPIDS OF Arctia caja MOTHS. Acta biochim. polon. 9, 2 (1962) 95-110. (In Polish, with English summary).

The incorporation rate of P^{32} into inositol phosphatide was higher than that into lecithin, phosphatidyl ethanolamine or phosphatidyl serine. The kinetics of labelling do not substantiate the supposition of lecithin or phosphatidyl serine arising from phosphatidyl ethanolamine. Phosphoryl-choline may be the precursor of lecithins. No difference was found in the incorporation rates of P^{32} into lecithins differing in unsaturation degree of fatty acid moieties. (Auth.)

373* Clayton, R.B. THE ROLE OF INTESTINAL SYMBIONTS IN THE STEROL METABOLISM OF Blatteila germanica. J. biol. Chem. 235 (1960) 3421-5.

A group of 200 adults roaches were fed 10 g of artificial diet containing 0.1% cholesterol to which 30 mg of sodium acetate-1-C^{14} (1.8×10^7 cpm/mg) had been added. After 25 d, the diet was consumed and the insects killed. The subsequent procedure is described. The principal sterol synthesized under nonaseptic conditions could be shown to be 22-dehydrocholesterol. Evidence is presented for the derivation of this material from ergosterol synthesized by the intestinal flora of the insect. The metabolic conversion of ergosterol to 22-dehydrocholesterol is shown to be independent of the microbial population of the intestine. The possible significance of trace amounts of sterols synthesized in aseptic as well as nonaseptic roaches is discussed.

374 Clayton, R.B., Edwards, A.M. ESSENTIAL CHOLESTEROL REQUIREMENT OF THE ROACH. Biochem. biophys. Res. Commun. 6 (1961) 281-4.

All the tissues of Eurycotis floridana reared on a synthetic diet containing 0.1% cholesterol-4-C^{14} (diet A) contained cholesterol. E. floridana reared on a synthetic diet containing 0.1% cholestanol-7α-H^3 and 0.005% cholesterol-4-C^{14} (diet B) also contained cholesterol in all tissues. In only 2 tissues of insects reared on diet B (gastric caeca and midintestine) does cholesterol account for a smaller percentage of the

total sterol content than in the diet itself (5%): in all other tissues the percentage of cholesterol is equal (Malpighian tubules) or considerably higher (fat body, muscle, cuticle, ventral nerve cord) than that of the diet. Proportions of free and esterified cholesterol vary according to the tissue on diet A, but cholesterol in the tissues is almost entirely unesterified on diet B. On diet B the esterified sterol fraction is almost wholly cholestanol. The minimum essential cholesterol requirement of this insect is not completely metabolized. (CA 56: 1962, 7822f)

375 Clayton, R.B., Edwards, A.M., Bloch, K. BIOSYNTHESIS OF CHOLESTEROL IN AN INSECT, SILVERFISH. Nature, Lond. 195 (1962) 1125-6.

Non-sterile Ctenolepisma at various stages of growth were maintained for 7 months under ordinary laboratory conditions. At the end of this time the insects were extracted, the lipid extract hydrolyzed, and the sterol fraction acetylated and subjected to chromatography. The ingestion of Na acetate-1-C^{14} by the silverfish leads to the appearance of labelled cholesterol in the tissues of the insect. No 22-dehydrocholesterol was detected. (CA 57: 1962, 17225d)

376 Clayton, R.B., Bloch, K. STEROL UTILIZATION IN THE HIDE BEETLE, Dermestes vulpinus. J. biol. Chem. 238, 2 (1963) 586-91.

The capacity of sterols of different structural types to spare the normal dietary cholesterol requirements of D. vulpinus was studied. Correlations were made between structure and cholesterol-sparing efficiency of the compounds tested, and an attempt was made to interpret the results on the basis of the assumption that there sterols are incorporated unchanged into functional spaces normally occupied by cholesterol. (In the present series of experiments the sample of $\Delta^{5,7}$-cholestadienol was commercial material, shown to be uncontaminated with cholesterol by a procedure in which the dienol was first mixed with C^{14}-labelled cholesterol and subsequently separated from it chromatographically. This material was found to be incapable of replacing cholesterol entirely, although the test had indicated that its sparing activity was complete).

377 Crone, H.D., Bridges, R.G. PHOSPHOLIPIDS OF THE HOUSEFLY (Musca domestica) STABLE TO HYDROLYSIS BY MILD ALKALI AND ACID. Biochem. J. 84 (1962) 101P.

On hydrolysis (procedure as described by Dawson in Biochem. J. 75: 1960, 45) carried out on housefly extracts, 4.6% of the phospholipid phosphorus remained lipid-bound after hydrolysis with mild alkali and mild acid. This "stable fraction" could be resolved into 2 components (method as in Biochim biophys. Acta 21: 1956, 168). Hydrolysis of the "stable fraction" with 15% (v/v) HCl in methanol for 4 h at 100°C rendered a further 3.5% of the total phospholipid phosphorus water-soluble. The specific activities of the 2 fractions of this hydrolysate were different for extracts of phospholipids from flies fed on P^{32}-labelled orthophosphate. The possible implications of the existence of these 2 fractions are discussed.

378 Crone, H.D., Bridges, R.G. THE PHOSPHOLIPIDS OF THE HOUSEFLY, Musca domestica. Biochem. J. 89 (1963) 11-21.

L-[β-C^{14}] Serine (specific radioactivity 30 μc/mg) and carrier-free P^{32}-labelled orthophosphate solution in dilute HCl (radioactivity 5 mc/ml) were available. The techniques used for labelling 1-d-old flies are described. For intra-thoracic injection, 1 μl of the orthophosphate solution (5 μc) or the serine (0.14 μc) were administered. Subsequent extraction of phospholipids, the fractionation of phospholipids on columns of silicic acid, paper chromatography and colour reactions on paper chromatograms, location of radioactive compounds, hydrolytic procedures, chemical determinations, and measurements of specific radioactivity are described in detail. The major components of the phospholipid fraction of the housefly are phosphatidylethanolamine (65% of total lipid P), phosphatidylcholine (17%), phosphatidylserine (3.5%), phosphoinositide (3%), a material believed to be a polyglycerophosphatide (5%), plasmalogen (1.3%), a glycerol ether phosphatide (1%), and sphingolipid containing P and ethanolamine (3.5%). Neither sphingomyelin nor sugar-containing lipids could be detected positively in the lipid extracts. Isotopic equilibrium between the P introduced and the P of the lipids was not obtained, even long after isotope introduction. Main differences between housefly and mammal phospholipids appear to be low plasmalogen content, absence of sphingolyelin, occurrence of a sphingolipid containing P and ethanolamine, and the predominance of phosphatidylethanolamine.

379 Dutky, R.C., Robbins, W.E., Kaplanis, J.N., Shortino, T.J. THE STEROL ESTERS OF HOUSEFLY EGGS. Comp. Biochem. Physiol. 9 (1963) 251-5.

The free sterols and sterol esters from adult female Musca domestica L. and eggs were separated by column chromatography. The sterol ester fraction accounted for about 41% of the total sterol from housefly eggs but only about 8.4% in the female flies. 4-C^{14}-cholesterol with a low specific activity (7.9×10^4 cpm/mg) was used as the sole source of sterol and served as a marker in the chromatographic separations. Analysis of the fatty acids from the sterol ester fraction of the eggs showed these to be composed of greater than 90% C_{16} and C_{18} mono-unsaturated fatty acids with the C_{18} acids accounting for about 78% of the total. The fatty acids from the triglyceride fraction of the eggs and female flies differed from the egg sterol esters in that they contained less unsaturation and a predominance of C_{16} fatty acids.

380 Fast, P.G., Brown, A.W.A. LIPIDS OF DDT-RESISTANT AND SUSCEPTIBLE LARVAE OF Aedes aegypti. Ann. ent. Soc. Amer. 55, 6 (1962) 663-72.

No significant difference between DDT-resistant and susceptible strains of 3 different American stocks was found in total lipid or phospholipid content of the larvae. Two DDT-resistant strains of an Asiatic stock, one developed by malathion selection, contained 10%-25% more phospholipid than the susceptible strain, and the interstrain difference in the larval heads was even greater. However towards the end of the investigation the phospholipid content of the susceptible strain increased, to equal that of the resistant strains. Breakdown of phospholipid and total lipid was equally fast in the resistant and susceptible strains, both in DDT-contaminated and in distilled water. Isolated nerve cords of the 2 DDT-resistant Asiatic strains developed symptoms of DDT-poisoning as fast as the susceptible strain. The DDT-resistant strain developed by malathion pressure absorbed radioactive DDT one-half as fast, and retained twice as much DDT in the gut, as the susceptible strain. C^{14}-DDT ring-labelled on the para-carbons only was used. The principal fatty acid of neutral lipids and phospholipids in Aëdes aegypti was palmitoleic acid; the principal phospholipid fraction was cephalin, as in other Diptera. Two sets of experiments were made with larvae in which their phospholipid had been labelled with P^{32} (orthophosphate in rearing medium). No qualitative differences in the lipids and phospholipids were found between resistant and susceptible strains, except in one of the American stocks. (Auth.)

381 Ishii, S., Kaplanis, J.N., Robbins, W.E. DISTRIBUTION AND FATE OF 4-C^{14}-CHOLESTEROL IN THE ADULT MALE AMERICAN COCKROACH. Ann. ent. Soc. Amer. 56, 1 (1963) 115-9.

The distribution and fate of 4-C^{14}-cholesterol was studied in adult male American cockroaches (Periplaneta americana (L.)) at 1, 10, and 20 d following injection. More than 80% of the administered radioactivity was still present in the cockroaches at the end of 20 d, indicating a strict sterol economy. Exchange and transport of 4-C^{14}-cholesterol between organs and tissues were evidenced by the continuing presence of radioactive compounds in the haemolymph and changes in the concentration of C^{14} compounds in several tissues. Paper chromatographic analyses of extracts indicated the presence of free sterols, sterol esters, and more polar steroids in all the tissues examined. Free sterols were predominant, accounting for 55% to 98% of the radioactive compounds present. The highest percentage of radioactive sterol esters (44%) was found in the fat body. Polar steroids were found in low concentrations except in the midgut and hindgut, where they accounted for more than one-tenth of the total radioactivity. When the C^{14} sterols isolated from whole insects were analyzed by gas-liquid chromatography and reverse isotope dilution, greater than 97% of radioactivity was found to behave like unchanged cholesterol. (Auth.)

382 Kaplanis, J.N., Dutky, R.C., Robbins, W.E. THE INCORPORATION OF 2-C^{14} - MEVALONATE INTO HOUSE FLY LIPIDS. Ann. ent. Soc. Amer. 54, 1 (1961) 114-6.

When 2-C^{14}-mevalonate was injected into male and female houseflies (Musca domestica L.) at 10 µc per fly, about the same amount of radioactivity was incorporated into the saponifiable and unsaponifiable lipids after 18 h. Fractionation of the unsaponifiable material by column chromatography demonstrated that less than 17% of the radioactive material behaved as hydrocarbons, and more than 40% was eluted in the sterol fraction. However, when this fraction was analyzed by digitonin precipitation, only trace amounts of radioactivity were precipitated with the sterol digitonides, indicating that the previously reported absence of sterol synthesis from C^{14}-acetate in the adult housefly is not due to a metabolic block in the biosynthetic pathway between acetate and mevalonate. (Auth.)

383 Kaplanis, J.N., Monroe, R.E., Robbins, W.E., Louloudes, S.J. THE FATE OF DIETARY H^3-β-SITOSTEROL IN THE ADULT HOUSE FLY. Ann. ent. Soc. Amer. 56 (1963) 198-201.

Adult houseflies (Musca domestica L.) were maintained on a semi-defined diet containing 0.1% H^3-β-sitosterol and their eggs collected over a 22-d period. Although the major portion of the radioactive compounds

in both the adult flies and eggs behaved as free sterols, as much as 30% of the H^3 compounds in the eggs was esterified. Column chromatographic analyses of the free sterol and ester fractions indicated the presence of two major radioactive peaks. When the largest peak, which accounted for 88% to 95% of the total H^3 compounds, was analysed by gas-liquid chromatography and reverse-isotope dilution, more than 90% of the radioactivity was found to represent β-sitosterol. No conversion of β-sitosterol to cholesterol was detected. The minor peak, which contained 5,7-dienes, was tentatively identified as 7-dehydro-β-sitosterol. These results indicate that the housefly utilizes β-sitosterol directly and as a precursor to 7-dehydro-β-sitosterol without detectable conversion to cholesterol. (Auth.)

384 Kaplanis, J.N., Robbins, W.E., Vroman, H.E., Bryce, B.M. THE ABSENCE OF CHOLESTEROL BIOSYNTHESIS IN A PRIMITIVE INSECT; THE FIREBRAT. Steroids 2, 5 (1963) 547-53.

It has been postulated that certain of the more primitive insects may be capable of residual cholesterol synthesis in contrast to the higher forms in which this capacity was lost through evolution. The recent report of high incorporation of dietary acetate-1-C^{14} into cholesterol by a silverfish merited examination in another primitive insect. Hence, several groups of Thermobia domestica were either fed a diet containing acetate-1-C^{14} or injected with an aqueous solution of the labelled compound. Radioanalysis of the total lipids indicated efficient incorporation of the acetate for lipid synthesis by both routes of administration. Gas-chromatographic analysis of the nonsaponifiable lipids revealed cholesterol to be the major sterol present. After the addition of purified carrier cholesterol, the sterols were isolated from the nonsaponifiable lipids by chromatography on alumina and digitonin precipitation. When the sterols from all the experiments were combined and purified through the dibromide, the cholesterol had a specific activity of 3.5 cpm/mg, yielding a total incorporation of about 39 cpm. This radioactivity represents about 0.001% of that incorporated into total lipids. (CA 60: 1964, 4511c)

385 Karlson, P., Maurer, R., Wenzel, M. A MICROMETHOD FOR LABELING STEROIDS AND ECDYSONE WITH TRITIUM. Z. Naturf. 18b (1963) 219-24.

5α-Pregn-1-ene-17α,21-diol-3,11,20-trione-21 acetate and 5α-pregnane-17α,21-diol-3,11,20-trione 21-acetate were used as model compounds. Tritiation was carried out by a modified Wilzbach technique (CA 51, 10359a) at room temperature on activated C. The tritiated substances were purified by thin-layer chromatography. The method gave good specific activity with relatively small amounts of tritiated side products. A sample of ecdysone was similarly treated, but at -196°, and very low specific activity was achieved, as was also the case with the model compounds at this temperature. (CA 59: 1963, 1954e)

386 Lambremont, E.N. In vivo INCORPORATION OF ACETATE-1-C^{14} INTO LIPIDS BY THE BOLL WEEVIL. (Abstr. 36). Bull. ent. Soc. Amer. 9, 3 (1963) 162.

Adult boll weevils incorporate injected acetate-1-C^{14} into the saponifiable and nonsaponifiable lipid fractions. The incorporation ratio is approximately 9:1 in favour of the saponifiable lipids during the 2 h after injection. Silicic acid chromatography indicates higher synthesis rates in the cholesterol esters and phospholipids than in the neutral glycerides.

387 Lasser, N.L., Clayton, R.B., Edwards, A.M. THE DYNAMIC STATE OF STEROLS IN THE COCKROACH. (Abstr. 2567). Fed. Proc. 22, 2 (1963) 590.

The roach, Eurycotis floridana, reared aseptically on a diet containing minimal cholesterol-C^{14} (0.005%), and a cholesterol-sparing sterol (cholestanol-H^3, 0.1%), retains both sterols in its tissues in concentrations varying among the tissues, the cholesterol being virtually all unesterified and the sparing sterol both free and esterified. Individuals from a colony of such insects were analyzed when half-grown. The concentrations of esterified and free cholesterol and sparing sterol in the different tissues were determined. The remainder of the colony was allowed to grow to maturity on a diet containing the same concentrations of unlabelled sterols and were then similarly analysed. The growth of the insects during the second half of the experiment and the concentrations and specific activities of the labelled sterols remaining were considered with the aim of assessing the extent of turnover of sterols during this period. The results indicated little or no turnover of cholesterol, but considerable turnover of sparing sterol, primarily in the unesterified fraction. Displacement of labelled non-esterified sparing sterol into the esterified fraction took place during this period of growth. These results are consistent with the presence of at least 3 functionally distinct sterol pools in the tissues of this insect.

388 Louloudes, S.J., Kaplanis, J.N., Robbins, W.E., Monroe, R.E. LIPOGENESIS FROM C^{14}-ACETATE BY THE AMERICAN COCKROACH. Ann. ent. Soc. Amer. 54, 1 (1961) 99-103.

Adult American cockroaches (Periplaneta americana) were injected with an aqueous solution of 1-C^{14}-sodium acetate and held for 24 h. On analysis, the rate of fatty acid synthesis from C^{14}-acetate was found to be 2.5 to 4.7 times greater in male than in female cockroaches. Analysis of the fatty acid methyl esters by gas-liquid chromatography demonstrated the relative distribution of radioactivity to be similar for both sexes. Both the male and female cockroaches incorporated approximately the same percentage of radioactivity into the unsaponifiable fraction. Fractionation by column chromatography demonstrated that 59% to 68% of the radioactivity behaved as hydrocarbons and 5% to 8% as sterols. None of the radioactivity in the hydrocarbon fraction behaved as squalene when analyzed by paper chromatography. Only low levels of radioactivity were found in the digitonin precipitates of the sterol fraction, none of which showed distinct peaks corresponding to either the Δ^5 or $\Delta^{5,7}$ sterol acetates following acetylation and chromatography on alumina. (Auth.)

389 Louloudes, S.J., Thompson, M.J., Monroe, R.E., Robbins, W.E. CONVERSION OF CHOLESTANOL TO Δ^7-CHOLESTENOL BY THE GERMAN COCKROACH. Biochem. Biophys. Res. Commun. 8, 2 (1962) 104-6.

Reference is made to an unpublished study by Louloudes et al. concerned with the utilization and metabolism of dietary 4-C^{14}-cholestanol by Blattella germanica (L.); no conversion of cholestanol to cholesterol had been detected. However, as much as $\frac{1}{2}$ of the total C^{14} sterols isolated from the roaches was a cholestanol metabolite, which behaved as Δ^7-cholestenol when either the free sterol or its acetate was analysed by gas-liquid chromatography and reverse isotope dilution. This metabolite was also found to be formed from C^{14}-cholestanol in roaches reared under aseptic conditions. An attempt was made in the present study to identify the metabolite. Large numbers of roaches were reared on a synthetic diet containing 0.2% cholestanol and subminimal quantities of cholesterol. The extraction and subsequent analysis procedures are described. Cholestanol and Δ^7-cholestenol were identified. The significance of this conversion (of a stanol to a Δ^7-stenol) and the accumulation and function of the metabolite in the insect is not fully understood.

390 Piek, T. SYNTHESIS OF WAX IN THE HONEYBEE (Apis mellifera). Proc. Acad. Sci. Amst. Ser. C 64 (1961) 648-54. (In English).

Newly emerged bees, caged with a dead queen to stimulate comb building, were given food containing heavy water, D-labelled AcONa (I), or AcONa-1-C^{14} (II) for 2 weeks. The petroleum ether extracts of these bees and of their combs were fractionated chromatographically and the fractions examined for radioactivity. Heavy water produced no extreme differences in labelling of different lipid fractions indicating universal use of D in their synthesis. I and II failed to produce highly labelled wax esters (C_{18-24} acids and C_{24-34} alcohols) whose synthesis occurs in the combined fat cells which appear able to take up monoses from the body fluid but not AcOH, I, or II. However, I and II produced highly labelled C_{24-32} wax acids and C_{25-31} hydrocarbons, synthesis of which takes place in the oenocytes which appear able to take up acetate (or related compounds) derived from sugar degradation elsewhere. Both tissues transmit their lipid products to the wax glands. (CA 56: 1962, 14749i)

391 Rajalakshmi, S., Sarma, D.S.R.*, Sarma, P.S. BIOSYNTHESIS OF FATTY ACID IN RICE MOTH. Indian J. exp. Biol. 1, 3 (1963) 155.

The involvement of biotin as a coenzyme during biosynthesis of fatty acids from acetate-1-C^{14} was demonstrated in the larvae of Corcyra cephalonica. (CA 59: 1963, 11945b)

392 Rajalakshmi, S., Sharma, D.S.R.*, Sharma, P.S.* CHOLESTEROL METABOLISM IN Corcyra cephalonica. Indian J. exp. Biol. 1, 4 (1963) 186-9.

Of several compounds tested, inositol was found to reverse the cholesterol accumulation and growth inhibition induced by γ-hexachlorocyclohexane in the larvae of rice moth, C. cephalonica. By using labelled acetate, mevalonic acid, and ergosterol, it was demonstrated that in this insect, cholesterol synthesis was absent and that ergosterol was converted to cholesterol. The experiments suggested a key role for inositol in maintenance of normal sterol level in the larval tissues of C. cephalonica. (CA 60: 1964, 4511a)

* A printing error (CA) is undoubtedly responsible for the differences in second and third authors in 391 and 392.

393 Robbins, W.E., Kaplanis, J.N., Monroe, R.E., Tabor, L.A. THE UTILIZATION OF DIETARY CHOLESTEROL BY GERMAN COCKROACHES. Ann. ent. Soc. Amer. 54, 2 (1961) 165-8.

The absorption and metabolism of 4-C^{14}-cholesterol by nymphal German cockroaches (Blattella germanica (L.)) was studied after two weeks on diets containing 0.05% C^{14}-cholesterol with and without the sterol antagonist, cholesteryl chloride, at a 1:10 ratio. Dietary cholesterol was efficiently utilized when fed alone, with greater than 90% of the ingested sterol retained. Cholesteryl chloride caused only about a 9% to 11% decrease in cholesterol utilization, as determined from the relative amounts of C^{14} compounds present in the roaches and their excreta. About 93% of the C^{14} compounds from the roaches behaved chromatographically as free sterols, 5% as esters, and the remainder as more polar compounds. Analyses of the free and esterified sterols by column chromatography and reverse-isotope dilution demonstrated that unchanged cholesterol accounted for 95% of these fractions and another 2.5% behaved like 7-dehydrocholesterol. No significant amounts of either C^{14}-labelled bile acids or coprostanol were detected in the excreta. (Auth.)

394 Robbins, W.E., Dutky, R.C., Monroe, R.E., Kaplanis, J.N. THE METABOLISM OF H^3-β-SITOSTEROL BY THE GERMAN COCKROACH. Ann. ent. Soc. Amer. 55 (1962) 102-4.

A study was made of the metabolism of β-sitosterol by nymphal German cockroaches (Blatella germanica (L.)) held for 42 days on a synthetic diet containing 0.2% of the H^3-labelled sterol. Analysis of the total H^3-compounds from the cockroaches indicated about 93% was present as free sterols and only 6% as esters. When the Δ^5 fraction, which accounted for about 97% of the total H^3-sterols in the cockroaches, was analysed by gas chromatography and/or reverse isotope dilution, about 80% was found to be cholesterol and only about 7% behaved like unchanged β-sitosterol. These data indicate that the German cockroach has available the biochemical mechanism for the removal of the 24-ethyl group from the β-sitosterol side chain. (Auth.)

395 Robbins, W.E. STUDIES ON THE UTILIZATION, METABOLISM AND FUNCTION OF STEROLS IN THE HOUSE-FLY Musca domestica. p.269-79 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963", Vienna, International Atomic Energy Agency. 1963.

Insects generally have been found to require a dietary source of sterol for normal larval growth and metamorphosis. Our work has pointed to two additional physiological roles for sterols in M. domestica L.: (1) A dietary source of sterol is essential for sustained viable egg production in the female fly; on a sterol-deficient diet eggs are produced but hatch and viability are low. (2) Cholesterol is also involved in the mobilization and utilization of nutrient reserves associated with the initiation of ovarian maturation in the female fly. The quantitative sterol requirements for the above physiological processes and the metabolic conversions that occur during growth, metamorphosis and reproduction have been studied in this insect, using C^{14}- and H^3-labelled sterols in conjunction with a variety of analytical tools, including reverse isotope dilution, gas-liquid chromatography and spectroscopy, and employing aseptic rearing techniques and semi-defined larval and adult diets. Both C^{14}-cholesterol and H^3-β-sitosterol have been used as a source of sterol in either the larval or the adult diet, and the pattern of utilization and metabolism was found to be almost identical for these two sterols. However, there was no detectable conversion of β-sitosterol to cholesterol. Sub-minimal quantities of cholesterol have also been used in the larval diet in combination with "sparing sterols" such as cholestanol, which will fulfill in part but not entirely the sterol requirement of this insect. The utilization and fate of the "sparing sterol" has been investigated using C^{14}-cholestanol, and the metabolism of the minute quantity of essential cholesterol is currently under study using high-specific-activity C^{14}-cholesterol. Other species of insects, including the German cockroach (Blattella germanica), have been examined in relation to the patterns of utilization and the metabolic pathways for sterols found in the housefly. (Auth.)

396 Saito, M., Yamazaki, M., Kobayashi, M. STEROID BIOSYNTHESIS IN THE SILKWORM. Nature, Lond. 198 (1963) 1324.

Experiments were carried out in order to investigate whether in Bombyx mori sterol is biosynthesized from the acetate of the same precursor as in mammals, or whether the sterol biosynthesis has an intimate relation to a stage in post-embryonic development. 2-C^{14}-acetate was therefore injected into silkworm larvae, pupae, and "Dauer" pupae. Details of the technique, the stages tested and the resulting radioactivity are given. A table summarizes the incorporation of 2-C^{14}-acetate into digitonide in the silkworm. The authors suggest that C^{14}-acetate is also a precursor of sterol in the silkworm pupae. The "Dauer" pupa,

30 d old, however, either cannot synthesize sterol from C^{14}-acetate or, if such a chemical system is present, it is very weak. This fact may suggest that the brain takes part in the sterol metabolism in the silkworm.

397 Sedee, P.D.J.W. INTERMEDIARY METABOLISM IN ASEPTICALLY REARED BLOWFLY LARVAE. I. BIOSYNTHESIS OF SQUALENE AND CHOLESTEROL. Arch. Int. Physiol. Biochim. 69 (1961) 284-94.

Two experiments were performed with larvae of Calliphora erythrocephala. Larvae were unable to synthesize cholesterol from acetate or to synthesize or use squalene in lieu of cholesterol for growth and development. Media with squalene and cholesterol supported growth and development. No C^{14} from acetate was found in isolated cholesterol. High radioactivity was found in the non-saponifiable fraction. (CA 56: 1962, 786e)

398 Sedee, P.D.J.W. INTERMEDIARY METABOLISM IN ASEPTICALLY REARED BLOWFLY LARVAE. II. BIOSYNTHESIS OF FATTY ACIDS AND AMINO ACIDS. Arch. Int. Physiol. Biochim. 69 (1961) 295-309.

Nonessential amino acids and fatty acids in Calliphora erythrocephala were determined with tracer acetate-1-C^{14}. Fatty acid and glycerol fractions of ether-extracted, aseptically-reared larvae were used. Moderate radioactivity in isolated glycerol showed that acetic acid took part indirectly in biosynthesis. Saturated and unsaturated fatty acids were not interconvertible by hydrogenation and dehydrogenation. Degradation studies showed fatty acids were synthesized by β-condensation from two different sources of 2-C units. In isolated amino acids, heavy incorporation of C^{14} was found in glutamic and aspartic acids and alanine; lesser amounts in serine, glycine, and proline. Insignificant amounts of isotope were found in phenylalanine, tyrosine, isoleucine, leucine, valine, histidine, arginine, and lysine. Isotope distribution in glutamic and aspartic acids and alanine showed that biosynthesis was similar to mammals. The presence of isotope in C-2 of glutamic acid indicated other pathways were also used. Tyrosine was synthesized from phenylalanine and proline from glutamic acid. Serine and glycine were closely linked. (CA 56: 1962, 786f)

399 Strong, F.E. In vivo SYNTHESIS OF FATTY ACIDS BY Myzus persicae (Sulz.). (Abstr. 68). Bull. ent. Soc. Amer. 8, 3 (1962) 156.

See 400.

400 Strong, F.E. FATTY ACIDS: In vivo SYNTHESIS BY THE GREEN PEACH APHID, Myzus persicae (Sulzer). Science 140, 3570 (1963) 983-4.

After feeding through an artificial membrane on an 18% sucrose solution containing either acetate-1-C^{14} or uniformly-labelled glucose-C^{14}, M. persicae incorporated 75% of the C^{14} into palmitoleic, stearic, and oleic acids. Small amounts were incorporated into myristic, linoleic, and linolenic acids; no significant amounts were incorporated into the short-chain fatty acids. (Auth.)

401 Tietz, A. FAT TRANSPORT IN THE LOCUST. J. Lipid Res. 3 (1961) 421-6.

When fat body tissue from locusts was incubated for 1 h with 0.3 μM of palmitate-1-C^{14} (I) in phosphate-saline, the fatty acid was readily taken up by the tissue. I (80-90%) in the tissue was recovered as glycerides. Glycerides were released into the medium from tissue prelabelled with I on incubation in haemolymph, and were then associated with lipoproteins, but this effect was not seen if phosphate-saline, bovine serum, or buffered albumin solutions were used as incubation media. Release of glycerides was inhibited by F^- or CN^-, and did not occur with heated haemolymph. The specific activity of the glycerides released was 10 times higher than the average specific activity of total tissue glycerides. (CA 58: 1963, 3710e)

402 Tietz, A. FAT SYNTHESIS IN CELL-FREE PREPARATIONS OF LOCUST FAT-BODY. Preprint 60, "Vth International Congress of Biochemistry, Moscow 10-16 August 1961. Symposium No. VII". 5p.

Fat-body tissue was removed from male and female locusts (Locusta migratoria) 7-14 d after the last molt, and tissue homogenates were prepared. These homogenates could synthesize fatty acids from acetate-C^{14} when supplemented with ATP, $MgCl_2$, glutathione, $KHCO_3$ and malonate. Addition of coenzyme A and triphosphopyridine nucleotides further stimulated synthesis. Malonate could not be replaced by any intermediate of the glycolytic or Krebs cycle. However, the addition of some intermediates in the presence of malonate caused further stimulation. The best results were obtained with α-ketoglutarate. A particle-free supernatant (20 000 g for 20 min) appears to contain all the systems necessary for fatty acid synthesis described elsewhere for liver and mammary gland, and here obtained from fat-body. C^{14}-labelled substrates were used to study the effects of malonate and $KHCO_3$ in the locust system. To test for a possible

connection between the decarboxylation of malonate and fatty acid synthesis the incorporation of acetate-1-C^{14} and of malonate-1-C^{14} into CO_2 and fatty acids by homogenate, supernatant and particles was compared.

403 VandenHeuvel, W.J.A., Robbins, W.E., Kaplanis, J.N., Louloudes, S.J., Homing, E.C. THE MAJOR STEROL FROM CHOLESTEROL-FED AMERICAN COCKROACHES. Ann. ent. Soc. Amer. 55 (1962) 723.

The major sterol extracted from male Periplaneta americana kept for 20 d on a diet containing 0.1% cholesterol-C^{14} was identified as unchanged cholesterol by gas chromatography, infrared spectrum, optical rotation, and nuclear magnetic resonance spectrum. (CA 58: 1963, 9443g)

404 Vroman, H.E., Kaplanis, J.N., Robbins, W.E. LIPID TURNOVER IN THE AMERICAN COCKROACH. (Abstr. 33). Bull. ent. Soc. Amer. 9, 3 (1963) 162.

Female Periplaneta americana L. were injected with 1-C^{14}-sodium acetate, and after certain time intervals, groups of roaches were sacrificed and the radioactivity incorporated into the lipids was measured. The turnover of several lipid fractions was studied.

405 Young, R.G. THE BIOSYNTHESIS OF BEESWAX. Life Sci. 9 (1963) 676-9.

Sodium acetate-2-C^{14} (2-4 μc) was injected into the body cavity of Apis mellifera L. actively synthesizing wax. C^{14} was incorporated into the free acids and esters of the wax within a few hours. The specific activity of the wax was 5000 cpm.

406* Zebe, E.C., McShan, W.H. INCORPORATION OF ^{14}C ACETATE INTO LONG CHAIN FATTY ACIDS BY THE FAT BODY OF Prodenia eridania (Lep.). Biochim. biophys. Acta 31, 2 (1959) 513-8.

It was demonstrated that the fat body of the moth P. eridania contains a system which incorporates acetate into long chain fatty acids. It requires the presence of malonate, ATP (adenosine triphosphate), coenzyme A and glutathione or cysteine. Its properties were studied. Small amounts of fatty acids were also synthesized from glucose. The fatty acids formed by the system proved to be predominantly palmitic acid and small quantities of stearic, oleic, myristic and lauric acids. (Auth. summary)

See also:

185 Incorporation of P^{32} into the phosphorous compounds of the wax moth larvae. (Wlodawer, 1961)
187 Metabolic conversions during pupation of the Cecropia silkworm. 1. Deposition and utilization of nutrient reserves. (Bade and Wyatt, 1962)
246 Zur Biogenese des Ecdysons. I. Umwandlung von Cholesterin in Ecdyson. (An investigation of the biogenesis of ecdysone. I. Transformation of cholesterin into ecdysone). (Karlson and Hoffmeister, 1963)
281 Incorporation of ^{14}C-amino acids into protein and lipid fractions of silkworms. (Shigematsu, 1960)
314 L'utilisation de nucléosides dans l'ovaire du Grillon et ses variations au cours de l'ovogenèse. I. Incorporation dans l'ARN. (Favard-Séréno and Durand, 1963)
315 L'utilisation de nucléosides dans l'ovaire du Grillon et ses variations au cours de l'ovogenèse. II. Incorporation dans l'ADN. (Favard-Séréno and Durand, 1963)

I-B-7 ORGANIC ACIDS

407 Blair, J.A. CONVERSION OF PTEROYL-L-MONOGLUTAMIC-2-C^{14} ACID INTO ISOXANTHOPTERIN IN Drosophila melanogaster. Nature, Lond. 192 (1961) 757-8.

6-d-old larvae grown on media containing radioactive pteroyl-L-monoglutamic acid (folic acid) were allowed to pupate 48-56 h on moist filter paper. Radioactive areas from supernatant spots of ammoniated extracts of the crushed pupae were chromatographed with BuOH-HOAc-H_2O (4:1:5) on 3 mm paper. The presence of isoxanthopterin (I) and 2-amino-4-hydroxypteridine-6-carboxylic acid (II) was identified by their fluorescent characteristics at 365 mμ excitation. Further chromatographic purification of I with tert-BuOH-pyridine-H_2O (10:3:7) on 3 mm paper and quantity measurement (scintillation counting) showed it to account for 20% of the radioactive material present in the sample. Due to the wide distribution of I in nature, it is postulated that it represents the end product of folic acid catabolism. This conversion requires the presence of xanthine oxidase, and it is reported that a deficiency of this enzyme accounts for the failure of D. melanogaster mutants to metabolize I, these mutants accumulate large amounts of

2-amino-4-hydroxy-pteridine and biopterin. A proposed metabolic pathway is presented for the synthesis of biopterin from 2-amino-4-hydroxypteridine-6-carboxaldehyde in the absence of xanthine oxidase. (CA 56: 1962, 7817d)

408 Brenner-Holzach, O., Leuthardt, F. URIC ACID FORMATION FROM GLUCOSE CARBON IN Drosophila melanogaster. Preliminary report. Helv. chim. Acta 46, 4 (1963) 1426-8. (In German).

The larvae of D. melanogaster were fed with glucose-1-C^{14} or glucose-6-C^{14} and the specific activity of uric acid isolated from larvae was determined. In the purine skeleton C atoms 2 and 8 had a higher specific activity after feeding glucose-6-C^{14}. In homogenates of the larvae, glucose-1-C^{14} is more rapidly transformed into CO_2 than glucose-6-C^{14} and these atoms, therefore, differ in their contribution to the formation of activated formate. (CA 59: 1963, 6757f)

409 Hitchcock, M., Smith, I.N. DETOXICATION MECHANISMS IN THE TICK Boophilus decoloratus. Biochem. J. 87, 3 (1963) 34P-35P.

Part of the study of detoxication mechanisms consisted of injecting [C^{14}]benzoic acid, p-aminobenzoic acid or p-nitrobenzoic acid into ticks kept at 34°C. Extracts prepared after 24 h contained the N-aroyl derivatives of arginine and glutamic acid. These were identified by paper chromatography and ionophoresis, by dilution analysis of the C^{14}-labelled compounds and by conversion of the arginine derivatives into the related ornithines with arginase. When the aroyl-arginine derivatives were injected, glutamic acid derivatives were found in the extracts.

I-B-8 ANTIMETABOLITES

410 Kilgore, W.W., Painter, R.R. THE EFFECT OF 5-FLUOROURACIL ON THE VIABILITY OF HOUSE FLY EGGS. J. econ. Ent. 55, 5 (1962) 710-12.

When houseflies (Musca domestica L.) were fed a diet containing 5-fluorouracil-2-C^{14} for 36 to 48 h after emergence, a significant quantity of the antimetabolite, or a metabolic product, was incorporated into their eggs. The amount of radioactive material incorporated into the eggs was the highest in eggs deposited during the 1st day of oviposition. The viability of the eggs was very low during the first 4 d after the start of oviposition, but after the 4th day the viability increased as the amount of detectable radioactivity in the eggs decreased. (Auth.)

I-B-9 CELL, TISSUE, ORGAN

411 Treherne, J.E. RADIOISOTOPES AND THE INSECT CENTRAL NERVOUS SYSTEM. p.137-43 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency, 1962.

The influx of various radioactive compounds through the continuous cellular and fibrous membrane which envelopes the nervous system has been studied. It is currently believed that the perilemma functions as a diffusion barrier restricting the entry of such substances as Na and K ions and acetylcholine into the underlying nervous tissue. An attempt has been made to study this and other processes by investigating the uptake of C^{14}-labelled molecules in the abdominal nerve cord of the cockroach, Periplaneta americana. The biochemical events in insect nervous tissue were studied at the same time by following the metabolism of some labelled compounds in the nerve cord of the insect. Results are discussed in relation to current concepts of the physiology of the vertebrate nervous system. A better understanding of the permeability processes associated with the perilemma may help elucidate some insect toxicological problems.

412 Winteringham, F.P.W. RADIOACTIVE TRACER TECHNIQUES IN INSECT BIOCHEMISTRY. p.113-30 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960" and p.283-301 in "Radioisotopes in Tropical Medicine. Proceedings of a Symposium, Bangkok, 12-16 December 1960". Vienna, International Atomic Energy Agency, 1962.

Ways are described in which radioactive tracer techniques combined with micro-fractionation techniques such as paper chromatography have provided powerful tool for studying the biochemical problems of insect control by chemicals. An important aspect of this type of work is the separation, assay and identification of labelled compounds recovered in trace amounts from insect tissues. Automatic radiochromatographic

techniques are available, and identification may be established by co-chromatography with authentic compounds and by studying the action of chemical reagents and specific enzymes on the labelled fraction. By labelling pools of related metabolites in vivo the effects of insecticides upon the insect may be studied. Labelled pools are formed in vivo by feeding or injecting insects with suitable labelled compounds. Comparison of the labelled pools formed when acetate-2-C^{14} and P^{32}-labelled PO_4^{3-} were injected into adult insects provided valuable data on the biochemistry of insect nerve and muscle. Pools of metabolites labelled with C^{14} or P^{32} have served for studying the mode of action of dieldrin and other insecticides in the insect. Thus, the organophosphorus insecticides appear to slow the rate of acetylcholine synthesis in vivo although they are without effect on the corresponding enzyme system. Caution is advocated in interpreting tracer experiments bearing on insect resistance problems.

413 Yudin, L.A. SALIVARY GLAND FUNCTION STUDIED BY RADIOACTIVE ISOTOPES. Med. Radiol., Moscow 6, 10 (1961) 78-85.

A review with numerous references.

414 Avery, J.A. A STUDY OF THE HAEMOCYTES OF THE GRASSHOPPER, Melanoplus differentialis (Thomas) (ORTHOPTERA: ACRIDIDAE). Diss. Abstr. 24, 4 (1963) 1753.

Emphasis was placed in the investigation on fluctuations in the number of circulating haemocytes during post-embryonic development. Average daily haemocyte counts were made, starting within 6 h after hatching and continuing through the first 10 d of the adult. Counts were made on older adults at 5-d- and then 10-d-intervals, terminating with 100-d-old adults. That a change in haemolymph volume is not solely responsible for the observed changes in the average number of circulating haemocytes during a particular developmental stage is shown by results obtained from haemolymph volume per cent determinations made on selected days of the 6th stadium and the adult using the C^{14}-carboxyl labelled inulin dilution technique. From an average of 40.3 haemolymph volume per cent on the 1st day of the 6th stadium there is a highly significant decrease to a low of 27.1% on the 5th day. This is followed by a gradual rise to 45.6 volume per cent at the end of the stadium. At ecdysis there is a non-significant decrease to 39.0 volume per cent on the 1st day of the adult followed by a slight increase, and then a gradual decrease to around 31% on the 20th day where it remains, with some fluctuations, through the 80th day. Differential haemocyte counts made from stained smears (Giemsa) and from fresh haemolymph indicate that differential, temporary adherence of the haemocytes to tissues combined with an alteration of haemolymph volume per cent may account for the repeated pattern of change in average total haemocyte counts.

415* Bricteux-Grégoire, S., Florkin, M. CONTRIBUTIONS A LA BIOCHIMIE DU VER A SOIE. II. TENEURS D'UN TISSU DE Bombyx mori EN EAU INTRACELLULAIRE ET EN EAU EXTRACELLULAIRE, ET RÉPARTITION DE L'AZOTE DIALYSABLE DANS CES DEUX FRACTIONS. Arch. int. Physiol. Biochim. 67, 1 (1959) 29-34.

De l'inuline-^{14}C (5 µl d'une solution contenant 245 µg d'inuline, correspondant à une radioactivité totale de 74 000 cpm, mesurée au compteur sans fenêtre, à courant gazeux) a été injectée dans l'hémocoele des vers à soie au stade du 5^{e} âge. Le tube musculo-cutané a été prélevé 20 h plus tard. L'activité totale du tissu et l'activité spécifique du plasma rapportée à sa teneur en eau, ont fourni les éléments de la détermination de l'eau extracellulaire et par conséquent de l'eau intracellulaire (eau totale - eau extracellulaire). Sa connaissance a permis de montrer que l'azote dialysable est environ deux fois plus concentré dans le liquide intracellulaire. Toutefois certains acides aminés, comme la lysine et l'histidine, existent à des concentrations beaucoup plus élevées dans le liquide extracellulaire.

416 Chandley, A.C. THE TIMING OF SPERMATOGENESIS IN Drosophila melanogaster USING TRITIATED THYMIDINE. (Abstr.). Heredity 17 (1962) 303.

See 418.

417 Chandley, A.C. THE TIMING OF SPERMATOGENESIS IN Drosophila melanogaster USING TRITIATED THYMIDINE. (Abstr.). Ann. human Genet. 25, 4 (1962) 427.

See 418.

418 Chandley, A.C., Bateman, A.J. TIMING OF SPERMATOGENESIS IN Drosophila melanogaster USING TRITIATED THYMIDINE. Nature, Lond. 193 (1962) 299-300.

In order to time the spermatogenetic cycle directly tritiated thymidine was injected into the abdomen of newly emerged males (0.08 mm^3, with an activity of 25 μc/ml). Mating, dissecting, sectioning and staining procedures followed are described. Feulgen-stained 8 μ-sections were autoradiographed. It is concluded that the period from synthesis of DNA in the spermatocyte to insemination in continuously mated males is 10 d. Of this interval, 4 d are taken up by spermatocyte maturation and 5 d by spermiogenesis, allowing 1 d for insemination. In males which were kept unmated until the sperm sampling, the rate of maturation of spermatocytes and spermatids was the same as in continuously mated males, but labelled sperm was not detected in the ejaculate until day 11 and then contributed a much smaller fraction of the sample. A table shows the sequence of irradiated stages present in sperm samples on successive days following irradiation - provided that all sperm is inseminated as soon as it matures.

419* Davis, R.P., Schneiderman, H.A. AN AUTORADIOGRAPHIC STUDY OF WOUND HEALING IN DIAPAUSING SILKWORM PUPAE. (Abstr.185). Anat. Rec. 137 (1960) 348.

To determine whether cell multiplication may play a role in wound healing in diapausing insects, autoradiographic techniques were utilized. Diapausing pupae of Hyalophora cecropia and Samia cynthia received injections of tritiated thymidine at various intervals following the infliction of a severe wound on the dorsum of the thorax. At subsequent intervals the wounded region was excised, fixed, and 5 μ thick sections of this area were prepared, placed on slides, and coated with a photographic emulsion. Examination of the preparations (developed and stained after 2 weeks) revealed that numerous epidermal cells in the wounded region had incorporated the labelled thymidine. Numerous blood cells were also labelled. Since thymidine is considered a specific precursor of DNA, DNA synthesis must have occurred. Such synthesis indicates that cell duplication plays a role in the wound healing process in these diapausing insects, despite the absence of ecdysone. (From abstr.)

420 Hamori, J. CHOLINESTERASES IN INSECT MUSCLE INNERVATION, WITH SPECIAL REFERENCE TO THE INSECTICIDAL EFFECTS OF DDT AND DFP. Bibliogr. anat. 2 (1961) 194-206. (In English).

Old and new data are given on cholinesterase (I) and similar esterases in the motor axons and motor end plates of various insect species. Histochemical evidence (discussed) indicates that the enzymes do not correspond with the forms of I found in vertebrates. New experiments were done on different muscles of various species of insects (including flight muscles of Apis mellifera) in different stages of DDT poisoning. In the early (hyperactivity) stages of poisoning, 30-60 min after applying DDT, the I of end plates and the thicker axons was considerably reduced in terms of K^{42} uptake of nervous and muscle tissue (quantitative data tabulated). Washing the muscles free of DDT with warm acetone completely restored enzyme activity. The toxic effect of DDT poisoning is brought about by changes in membrane permeability and not I inhibition. In experiments on peripheral nerves and ganglions of Lucanus cervus (stag beetles), Hydrophilus fluviatilis, Cerambyx cerda, and A. mellifera moderate DDT poisoning diminished the uptake of K^{42} but not of Na^{24} from surrounding aqueous media. However, the insecticidal effect of DFP probably results from inhibition of I. (CA 56: 1962, 2735f)

421 Heslop, J.P., Ray, J.W. NUCLEOTIDES AND OTHER PHOSPHORUS COMPOUNDS OF COCKROACH NERVE. Nature, Lond. 190 (1961) 1192-3.

An estimate was made, by the labelled pool technique, of the relative tissue concentrations of phosphorus compounds contained in the abdominal ventral cord of adult male Periplaneta americana. The procedure followed for extraction, analysis, and assessment are described. About 60% of the total P^{32} of the nerve is thus extracted. The total P of the abdominal nerve cord was found to be 1.41 mg/g wet weight (for method, see J. Biol. Chem. 234: 1959, 466). The approximate concentrations of the various compounds are tabulated.

422 Heslop, J.P., Ray, J.W. NUCLEOTIDES AND OTHER PHOSPHORUS COMPOUNDS OF THE COCKROACH CENTRAL NERVOUS SYSTEM. J. Insect Physiol. 7 (1961) 127-40.

Young adult males of Periplaneta americana were injected intra-abdominally with > 400 μc of carrier-free P^{32}-labelled orthophosphate, then maintained on a normal diet at 25-7°C for 7 d. Abdominal nervous tissue was then excised and extracted. Various fractions were studied by (paper and elution) chromatography and radiometric assay. Adenosine 5-mono-, di-, and tri-phosphates, cytidine 5-mono-, di-, and tri-phosphates, guanosine 5-di- and tri-phosphates, uridine 5-di- and tri-phosphates, di- and tri-phosphopyridine nucleotides (DPN, TPN), uridine diphosphoglucose, α-glycerophosphate, arginine phosphate, glucose-6-phosphate, and orthophosphate were tentatively identified and estimated in cockroach nerve. Concentrations of the various compounds in the abdominal cord were comparable to those found in

mammalian nervous tissue except that the cytidine and uridine nucleotides were higher. However, the apparent concentrations of some of the phosphates varied with the method of collecting and working up the nervous tissue. The amount of phospholipid in cockroach nerve was similar to that in mammalian peripheral nerve and lobster nerve.

423 Hogan, T.W. THE ABSORPTION AND SUBSEQUENT BREAKDOWN OF UREA BY DIAPAUSING EGGS OF Acheta commodus (Walk.) (ORTHOPTERA: GRYLLIDAE). Aust. J. Sci. 15, 2 (1962) 362-70.

Solutions of C^{14}-labelled urea were applied to diapausing eggs of Acheta and found to be absorbed into the eggs. The initial rate of intake varied with the temperature and also with the concentration of the applied solution. Eggs containing labelled urea showed a decline in their radioactivity after their removal from the urea solution. This was found to be due to the loss of C^{14} from the eggs in the form of $C^{14}O_2$, thus indicating a breakdown of the urea after entering the egg. Since the release of ammonia would be expected to follow the breakdown of urea, the effect of ammonium compounds on diapausing eggs was tested. Ammonium oxalate (0.025-0.55M) was found to be effective in accelerating the rate of termination of diapause. Certain other ammonium compounds were effective in preliminary trials. (From auth.)

424 Gordon, H.T., Waterhouse, D.F., Gilby, A.R. INCORPORATION OF ^{14}C-ACETATE INTO SCENT CONSTITUENTS OF THE GREEN VEGETABLE BUG. Nature, Lond. 197, 4869 (1963) 818.

The contents of the scent storage sac of the green vegetable bug, Nezara viridula var. smaragdula (F.) consist of a mixture of 2 liquid phases which are easily separated. Gas chromatographic analysis showed 13 peaks. Nezara could be shown to be capable of incorporating acetate into the major components of the scent (including hexanal, the unknown dicarbonyl, decenal and tridecane) and does not rely on concentrating unchanged, pre-formed materials from sap of the various plants on which it feeds in order to produce its characteristic scent.

425 Grell, E.H. THE GENETICS AND BIOCHEMISTRY OF RED FAT CELLS IN Drosophila melanogaster. Genetics 46 (1961) 925-33.

The red fat cells phenotype was found to have a digenic-basis. Two recessive mutations were called lys (lysine) and rc (red cells). The mutation lys, with or without rc, caused accumulation of lysine (chromatographic analysis) in larvae, pupae, and adults. A disturbance in the degradation of lysine was postulated and supported by data obtained from injection of C^{14}-lysine into lys and wild type flies. Red fat cells appeared if flies developed from starved lys larvae (without rc). (CA 56: 1962, 5239d and 7826d.)

426* Jacob, J., Sirlin, J.L. CELL FUNCTION IN THE OVARY OF Drosophila. I. DEOXYRIBONUCLEIC ACID (DNA) CLASSES IN NURSE CELL NUCLEI AS DETERMINED BY AUTORADIOGRAPHY. Chromosoma 10 (1959) 210-28.

Adult D. melanogaster were fed for 2-3 d on yeast mixed with adenine-8-C^{14}. After etherization of the flies, the ovaries were fixed in alcohol lightly stained in eosin, and quickly embedded in paraffin wax. The sections of 5 μ thickness lost their eosin by hydration and were treated with ribonuclease or deoxyribonuclease in Veronal buffer. After prolonged rinsing in distilled water, the slides were coated with Kodak autoradiography film, exposed for 3-12 d, developed, again rinsed for several h, and staining with methyl green-pyronin or aqueous yellowish eosin. After treatment with both enzymes a slight black colour still remained in the egg cells, caused by labelled proteins or prosthetic nucleotides. Both grain count and background errors were subtracted from the count. Determination of DNA by counting the reduced AgBr grains over the nuclei corroborated the results of Hertwig. DNA content doubled in each stage of the nurse nuclei up to the 9th (512 n), and slightly decreases in the 10th stage. Up to the 9th stage, DNA content, nuclear volume, and ploidy run parallel. (From E.M. Sect. I 14: 1960, 3772)

427 Kilby, B.A. THE BIOCHEMISTRY OF THE INSECT FAT BODY. p.111-74 in "Advances in Insect Physiology. Vol.I". Beament, J.W.L., Treherne, J.E., Wigglesworth, V.B., Eds. New York, Academic Press, 1963.

Review article, broken down into sections dealing with the nature of the fat body, carbohydrates and their metabolism, tissue respiration, lipids and the fat body, protein and amino acid metabolism, purines and pteridines, and pigments in the fat body. The two well defined functions of the fat body, storage and intermediary metabolism, are considered. Thus, the composition of insect blood can vary between much wider limits than are permissible in mammals, homeostatic regulation being effected by such tissues as the fat body. The level of blood glucose is relatively constant; a big rise after absorption through the gut of

digested carbohydrate is prevented by the rapid conversion of glucose into trehalose or glycogen by the fat body. A sharp fall in the blood trehalose concentration during periods of rapid utilization, as in flight, is prevented by an almost as rapid synthesis and release of trehalose by the fat body. Numerous radioisotope studies are cited throughout.

428 Olson, W.P., O'Brien, R.D. THE RELATION BETWEEN PHYSICAL PROPERTIES AND PENETRATION OF SOLUTES INTO COCKROACH CUTICLE. J. Insect Physiol. 9, 6 (1963) 777-86.

In determinations of the in vivo penetration of K_2HPO_4, H_3PO_4, dimethoate, paraoxon, dieldrin, and DDT (labelled with P^{32} or C^{14} and dissolved in various solvents) into the pronotum of Periplaneta americana from the waxy layer, it was found that the penetration followed 1st order kinetics. The rate of penetration increased with the polarity of the compounds. In certain cases, the epicuticular wax (I) was removed by mechanical means or the use of solvents, or both. The role of the I in regulating penetration was small when the solutes were topically applied in a small volume of a volatile organic solvent (such as acetone). Two functional layers of I were demonstrated. Dimethoate in water penetrated the cuticle slowly. Overall penetration was fastest with petroleum ether, less with acetone and with EtOH, and least with water. The kinetics of disappearance of solutes from the waxy layer are subjected to mathematical analysis and interpreted in relation to previous reports on the penetration of insecticides into the bodies of insects. (CA 60: 1964, 8384g)

429 Smith, D.S., Treherne, J.E. FUNCTIONAL ASPECTS OF THE ORGANIZATION OF THE INSECT NERVOUS SYSTEM. p.401-84 in "Advances in Insect Physiology. Vol.I". Beament, J.W.L., Treherne, J.E., Wigglesworth, V.B., Eds. New York, Academic Press. 1963.

Review articles, divided into sections dealing with the nerve sheath (the neural lamella and the perineurium), glial cells, the neurone, the neuropile, the extracellular system, and the neuromuscular junction. Close on 150 references are cited. Radioisotopes were used to measure the inulin space in the terminal abdominal ganglion of Periplaneta americana (C^{14}), and the efflux of Na^{24} from desheathed, terminal abdominal ganglia and whole isolated abdominal nerve cords could be shown to occur as a 2-stage process. The use of Na^{24}, Na^{22}, K^{42}, Ca^{45}, and Cl^{36} in whole isolated nerve cords indicated that the apparent concentrations of the rapidly exchanging fraction in the extracellular fluid were very different from those in the external medium. The ratio of efflux of C^{14}-inulin molecules and Na^{24} ions was shown to be similar to the ratio of their free diffusion constants. (See Treherne 1961, 1962).

430 Treherne, J.E. THE EXCHANGE AND METABOLISM OF SUGARS IN THE CENTRAL NERVOUS SYSTEM OF Periplaneta americana L. p.632-5 in "XI. Internationaler Kongress für Entomologie, Wien, 17. bis 25. August 1960. Verhandlungen. Band I (Symposien)". Wien, Organisationskommittee des XI. Internationalen Kongresses für Entomologie, Wien 1960. 1962. (In English).

10 µl of C^{14}-labelled glucose solution were injected into the haemolymph. Subsequent paper chromatography showed that the injected glucose was rapidly converted to trehalose, only very small amounts of glucose remaining in equilibrium with the trehalose. The rate of entry of radioactive material into the abdominal nerve cord was characterized by an initial steep rise due to the movement of a relatively small number of glucose molecules of high specific activity. The second, slower, increase represents the entry of C^{14} originating as trehalose (and glucose in equilibrium in the haemolymph). It appears that 90% of the carbohydrate material crosses the perilemma as the large trehalose molecules (ca. 7 molecules of trehalose to 1 of glucose, but since the trehalose molecules are 17 times more concentrated, individual glucose molecules must have been passing at 2.5 x the rate of trehalose). The prompt appearance of C^{14} in the C skeletons of aspartic acid, glutamic acid, and alanine represents circumstantial evidence for the existence of the Krebs tricarboxylic acid cycle enzymes in the CNS of the roach. More than ½ the administered C^{14} was found to be incorporated as glutamic acid and glutamine, suggesting that this very reactive amino acid occupies a central position in the metabolism of the cockroach CNS.

431 Treherne, J.E. SODIUM AND POTASSIUM FLUXES IN THE ABDOMINAL NERVE CORD OF THE COCKROACH. J. exp. Biol. 38 (1961) 315-22.

Influx of Na and K ions into the central nervous system of Periplaneta americana was studied by measuring the increase in radioactivity within the abdominal nerve cord following the injection of Na^{24} and K^{42} into the haemolymph. The influx of Na and K ions was approximately 320 and 312 mM/l of nerve cord H_2O/h, respectively. These values are approximately equivalent to an influx/unit area of nerve cord surface of 13.9 and 13.5 x 10^{-12} M/cm²/sec for Na and K ions, respectively. It is suggested that a dynamic steady

state rather than a static impermeability must exist across the sheath surrounding the central nervous system. (CA 55: 1961, 25070c)

432 Treherne, J.E. EXCHANGES OF SODIUM IONS IN THE CENTRAL NERVOUS SYSTEM OF AN INSECT (Periplaneta americana L.). Nature, Lond. 191 (1961) 1223-4.

The greater part of the efflux of Na^{24}, measured by determining the decline in radioactivity of isolated preparations maintained in a flowing physiological solution, was found to approximate to a simple exponential function, both for the whole nerve cord and for isolated fragments. Sodium ions thus appear to be extruded from the central nervous system by a metabolically maintained secretory mechanism which is also associated with the uptake of K ions. The rate of efflux of Na from the terminal abdominal ganglion was not appreciably affected by the removal of substantial portions of the perilemma. The rate-limiting process measured in these experiments is therefore not the ion transfer across the cellular perineurium, but the exchanges associated with some underlying cellular components of the CNS. The relatively rapid effects of the poison (2;4-dinitrophenol; cyanide) molecules and the K-free solutions on the measured effluxes from the intact abdominal nerve cord thus imply that the changes in the chemical composition of the external solution were quickly transmitted to the deeper layers of the CNS. The ionic fluxes calculated previously (see 431) are therefore an over-simplification.

433 Treherne, J.E. THE MOVEMENTS OF SODIUM IONS IN THE ISOLATED ABDOMINAL NERVE CORD OF THE COCKROACH. J. exp. Biol. 38 (1961) 629-36.

The rate of loss of Na from the abdominal nerve cord was determined by following the decline in radioactivity of Na^{24}-loaded nerve cords isolated in flowing Ringer solution. There was a rapid initial exponential decline in radioactivity which eventually gave way to a second slower phase. The initial extrusion of Na was appreciably reduced by the presence of KCN or 2,4-dinitrophenol. The rate of Na efflux was not reduced in Na-free solutions, but was decreased in the absence of external K ions. It appears that Na is extruded from the nerve cord by a metabolically maintained secretory mechanism which is also associated with the uptake of K. (CA 56: 1962, 7823f)

434 Treherne, J.E. THE EFFLUX OF SODIUM IONS FROM THE LAST ABDOMINAL GANGLION OF THE COCKROACH, Periplaneta americana L. J. exp. Biol. 38 (1961) 729-36.

The rate of loss of Na^{24} from the terminal abdominal ganglion was studied by measuring the decline in radioactivity associated with an isolated preparation maintained in flowing physiological solution. The rate of Na efflux was substantially reduced in the presence of 0.2 mM/l dinitrophenol and in K-free solution. The extrusion of Na^{24} was not significantly affected by the removal of the fibrous and cellular sheath surrounding the ganglion. The rate-limiting process in the efflux of Na measured in the experiments was not, therefore, the transfer of ions across the nerve sheath, but an extrusion from tissues lying at a deeper level in the central nervous system. (From auth. summary)

435 Treherne, J.E. THE KINETICS OF SODIUM TRANSFER IN THE CENTRAL NERVOUS SYSTEM OF THE COCKROACH, Periplaneta americana L. J. exp. Biol. 38 (1961) 737-46.

The exchange of Na ions was studied by following the escape of Na^{24} from isolated abdominal nerve cords, single connectives and ganglia. Particular attention was paid to the initial rapid exchanges of Na. The escape of Na ions occurred as a 2-stage process, the initial rapid phase giving way to a slower exponential phase of Na loss. The fast phase of efflux was not affected by the presence of 2;4-dinitrophenol, although this poison significantly reduced the 2nd slow phase of Na extrusion. The initial fast phase is attributed to a rapid diffusion from an extracellular space, demonstrated by C^{14}-inulin; the 2nd phase is identified as the slower extrusion from the cellular components of the CNS. (From auth. summary)

436 Treherne, J.E. THE DISTRIBUTION AND EXCHANGE OF SOME IONS AND MOLECULES IN THE CENTRAL NERVOUS SYSTEM OF Periplaneta americana L. J. exp. Biol. 39, 2 (1962) 193-217.

The rapidly exchanging Na^{24} fraction was found to account ~1/3 of the Na contained in desheathed abdominal ganglia which had been labelled by injection of labelled ions into the haemolymph. This Na was associated with the extracellular spaces which, with the aid of C^{14}-inulin, were shown to contain 18.2% of the ganglion water. The extracellular Na concentration was calculated as exceeding that in the haemolymph by a factor of 1.8 and being 2.5 times greater than in the cellular fraction of the ganglion. Experiments using Na^{24}, K^{42}, Cs^{45}, Cl^{36} and H^3OH showed that the concentrations of the ions in the rapidly exchanging extracellular fractions of isolated abdominal nerve cords were different from those of the

external medium. The 3 cations were maintained at considerably higher concentrations in the extracellular spaces, chloride ions being present at a much lower concentration than in the external solution. Ions were concluded to be distributed between the extracellular spaces and the external solution according to a Donnan equilibrium. The implications of the experimental results are discussed further.

437 Treherne, J.E. DISTRIBUTION OF WATER AND INORGANIC IONS IN THE CENTRAL NERVOUS SYSTEM OF AN INSECT (Periplaneta americana L.). Nature, Lond. 193 (1962) 750-2.

Na^{24}, K^{42}, Cl^{36} and Ca^{45} were used in an attempt to investigate the nature of the processes involved in the transfer and distribution of inorganic ions in the CNS of P. americana. The efflux of Na^{24} from the desheathed terminal abdominal ganglia (made radioactive by injection into the haemolymph) was found to approximate to a 2-stage process with rapid and slowly exchanging ion fractions. The rapidly exchanging fraction (identified with the ions in the extracellular spaces) represent ~1/3 of the total exchangeable Na in the ganglion. The extra-cellular space was measured by C^{14}-inulin. Calculations showed the concentration of Na ions in the extracellular fluid to exceed that of the haemolymph by a factor of 1.8 and to be 2.5 times greater than that of the cellular Na of the terminal abdominal ganglion. Observations on the concentrations of the K, Ca, and Cl ions were made using whole isolated abdominal nerve cord (nc). The efflux of tritiated water from the ligated nc also occurred as a 2-stage process. The levels of the various ions in the extracellular fluid were shown to differ markedly from those in the external medium, the cations being more and the chloride ions less concentrated. Implications are discussed.

438 Treherne, J.E. TRANSFER OF SUBSTANCES BETWEEN THE BLOOD AND CENTRAL NERVOUS SYSTEM IN VERTEBRATE AND INVERTEBRATE ANIMALS. Nature, Lond. 196 (1962) 1181-3.

Some results are summarized on the relatively simple arthropod central nervous system and considered in relation to the more complex physiological organization of the mammalian brain. Attention is paid to the exchanges of labelled (C^{14}, Na^{24}, K^{42}) sugars with the haemolymph, the size and structure of the extracellular space, and the composition of the extracellular fluid as compared with the haemolymph in the arthropod.

439 Wheeler, R.E. CHANGES IN HAEMOLYMPH VOLUME DURING THE MOULTING CYCLE OF Periplaneta americana L. (ORTHOPTERA). (Abstr.). Fed. Proc. 21, 2 (1962) 123.

The C^{14} inulin method was not suitable for determining the haemolymph volume. Large amounts of the radioactive inulin were masked by the plasma, and the data were exceedingly variable and lower than those found by other methods. With amaranth red, reliable haemolymph volumes could be determined during the last moulting cycle. Ranges and mean haemolymph volumes expressed as % body weight for each of the following stages were: (a) intermoult nymphs (11-30) 17%, (b) moulting nymphs (10-26) 14%, (c) adults at ecdysis (13-35) 21%, (d) 24 h old adults (13-19) 15%, and (e) more than 24 h old adults (14-27) 19%. The increased haemolymph volume at ecdysis is significant.

440 Wyatt, G.R., Kropf, R.B., Carey, F.G. THE CHEMISTRY OF INSECT HAEMOLYMPH. IV. ACID-SOLUBLE PHOSPHATES. J. Insect Physiol. 9, 2 (1963) 137-52.

The acid-soluble phosphate compounds in the haemolymph plasma of several lepidopterous insects have been fractionated quantitatively by ion-exchange chromatography, and the principal components identified. In Hyalophora cecropia, total acid-soluble P ranged from 26 to 44 mM, and the main components were inorganic orthophosphate, α-glycerophosphate, phosphorylcholine, and phosphorylethanolamine. Present in smaller amounts were uridine diphosphate n-acetylgalactosamine and some other uridine diphosphate derivatives. The presence of a phosphagen was also indicated. Quantitatively, orthophosphate and the basic phosphates tended to be more abundant during diapause than in the active stages, while glycerophosphate changed in the reverse manner. Injected orthophosphate-P^{32} was incorporated into the various esters at all stages, though at reduced rates during diapause; but when cell-free haemolymph was incubated with P^{32}, incorporation was negligible. In Antheraea polyphemus, Samia cynthia, and Protoparce sexta, the distribution of phosphates was similar to that in H. cecropia. In Bombyx mori, however, there was little α-glycerophosphate whereas sorbitol-6-phosphate was abundant and glucose-6-phosphate was also found. (Auth.)

See also:

23 Studies on the assimilation and excretion of labelled phosphate in aphids. (Kloft and Ehrhardt, 1962)
27 Studies on Chrysomela knabi. (Oak Ridge National Lab., Tenn., 1961)
151 Biochemistry of diapause, development, and injury in silkworm pupae. (Wyatt, 1963)

155 Uptake and elimination of cesium-137 by a grasshopper - Romalea microptera. (Crossley and Pryor, 1960)

201 Glycogen synthesis in the insect fat body. (Vardanis, 1963)

202 Biochemical changes associated with growth and development of the larval blowfly, Phormia regina, Meigen. (Wimer, 1963)

209 Autoradiographische Untersuchungen zur Dotterbildung. (Autoradiographic studies on yolk formation). (Bier, 1962)

226 Rate of equilibration of the contents of the gut of Anopheles quadrimaculatus larvae with the surrounding medium. (Friedman, 1963)

226 Glutamic acid carboxylase in the nervous tissue of insects. (Frontali, 1959).

249 Das Verhalten von freien Aminosäuren, energiereichen Phosphorsäure-Verbindungen und einigen Glykolyse- und Tricarbonsäurecyclus-Substraten in Muskeln von Locusta migratoria bei der Arbeit. (The behaviour of free amino acids, high energy phosphoric acid compounds and some glycolytic and tricarboxylic acid cycle substrates in the muscles of Locusta migratoria at work). (Kirsten et al., 1963)

252 In vitro synthesis of phosphoarginine by blowfly muscle. (Lewis and Fowler, 1962)

254 Fibroin biosynthesis in Samia ricini. (Lu and Wang, 1963)

256 The protein synthesis in silk glands. I. Transfer of radioactivity from prelabelled cell debris to particulate fractions in the cell-free systems of the posterior silk gland. (Miura et al., 1961)

257 The protein synthesis in silk glands. II. Effects of inhibitors on transfer of radioactivity and role of lipid fraction in protein synthesis. (Miura et al., 1961)

258 Protein synthesis in silk glands. III. Radioactive substances in cell debris. (Miura et al., 1962)

259 Studies on the protein synthesis in silk glands. IV. Incorporation of labelled glycine into the vesicular protein by posterior silk glands. (Miura et al., 1962)

269 Autoradiographic observations on the silk glands of Bombyx mori.

270 An autoradiographic study of protein synthesis in the cells of the fibroin portion of the silk gland in Bombyx mori. (Ramenskaya, 1962)

273 Fat body insects. Autoradiographic observations on incorporation of adenine-C^{14} and orotic acid-C^{14} in larval trophocytes of Musca domestica. (Russo-Caia, 1963)

276 Electron microscopic and some biochemical studies on the cell fractions of silk glands. (Seiichi and Shimura, 1961)

277 Biosynthesis of silk fibroin. III. In vivo incorporation of glycine-C^{14} into proteins of posterior silk gland fractions. (Seiichi and Shimura, 1961)

281 Incorporation of ^{14}C-amino acids into protein and lipid fractions of silkworms. (Shigematsu, 1960)

282 Kinetics of synthesis of fibroin in the posterior division of the silk-gland of the silkworm, Bombyx mori. (Shigematsu and Koyasako, 1962)

283 Silkworm development and silk production. (Shigematsu, 1963)

287 Pattern of protein sulfur after Feulgen hydrolysis in the salivary gland chromosomes of Drosophila melanogaster. (Sirlin and Knight, 1958)

289 Incorporation of labelled valine into the proteins of the Cecropia silkworm. (Skinner, 1963)

290 The metabolism of silk moth tissues. I. Incorporation of leucine into protein. (Stevenson and Wyatt, 1962)

293 Electron microscopic and some biochemical studies on the cell fractions of silk-glands. (Suto and Shimura, 1961)

297 Transfer of radioactivity from relabelled cell debris to particulate fractions in the posterior silk glands. (Tanaka, 1961)

299 Yellow pigments in the wings of papilionid butterflies. VI. Red pigments of the papilionid and nymphalid butterflies. (Umebachi, 1962)

300 Yellow pigments in the wings of papilionid butterflies. VII. Consideration of the nature and distribution of the wing pigments of the papilionid butterflies. (Umebachi, 1962)

303 Radiometric assay of acetylcholinesterase. (Winteringham and Diney, 1962)

304 Acetylcholinesterase activity and competitive inhibition at low substrate concentrations. (Winteringham and Diney, 1963)

312 Synthese, interzellulärer Transport, und Abbau von Ribonukleinsäure im Ovar der Stubenfliege Musca domestica. (Synthesis, intercellular transport, and breakdown of ribonucleic acid in the ovary of the housefly, Musca domestica). (Bier, 1963)

313 The synthesis of ribonucleic acid (RNA) by the ovary of the cricket. (Durand and Sérény, 1961)

321 Ribonucleic acid (RNA) metabolism in the posterior silk gland of silkworm, Bombyx mori, during the fifth instar. (Hosoda et al., 1963)

345 Incorporation of tritiated adenosine in the ovary of the cricket (Gryllus bimaculatus). (Séréno and Durand, 1960)

346 Incorporation of tritiated uridine into cricket ovaries. (Séréno and Durand, 1961)

347 Cell sites of RNA and protein syntheses in the salivary gland of Smittia (Chironomidae). (Sirlin, 1960)

348 Cell function in the ovary of Drosophila. II. Behavior of ribonucleic acid (RNA). (Sirlin and Jacob, 1960)

350 The relation of messenger to nucleolar RNA. (Sirlin et al., 1962)

401 Fat transport in the locust. (Tietz, 1961)

402 Fat synthesis in cell-free preparations of locust fat-body. (Tietz, 1961)

406 Incorporation of C^{14} acetate into long chain fatty acids by the fat body of Prodenia eridania (Lep.). (Zebe and McShan, 1959)

465 Inhibited oviposition by females of Gryllus assimilis (F.) induced by radioactive males, using L-methionine-methyl-C^{14}. (Abdel-Malek, 1961)

467 Inhibitory effect of L-methionine-methyl-C^{14} on oviposition by females of the cotton leaf worm, Prodenia litura (F.) induced by radioactive males. (Abdel-Malek, 1963)

638 The permeability of insect cuticle. (Matsumura, 1959)

1553 Diffusion of oil films over insects. (Lewis, 1962)

I-B-10 MISCELLANEOUS

441 Garey, F.G., Wyatt, G.R. PHOSPHATE COMPOUNDS IN TISSUES OF THE CECROPIA SILKMOTH DURING DIAPAUSE AND DEVELOPMENT. J. Insect Physiol. 9, 3 (1963) 317-35.

The acid-soluble phosphates from tissues of diapausing and developing pupae of the cecropia silkmoth have been analysed with a view to gaining evidence on metabolic regulation during metamorphosis. The phosphates from wing epidermis and fat body were fractionated by ion-exchange chromatography and measured directly and by isotope dilution. Results from wing epidermis were corrected for occluded haemolymph. Some measurements were also made of incorporation of injected P^{32}. Inorganic phosphate in fat body is very low (0.1 - 0.6 $\mu M/g$) and is taken up from haemolymph slowly in diapause and more rapidly in the developing adult; in wing tissue also it is lower than in the surrounding haemolymph. In both tissues, ATP:ADP ratios are high in diapause and rise little at the beginning of development, while AMP remains very low; from this, it is concluded that the limitation of biosynthetic rate in diapause is not a result of deficient oxidative phosphorylation. α-Glycerophosphate in fat body remains low during diapause and rises at the beginning of development, suggesting that diapause is not characterized by elevation of reduced coenzymes. Both tissues contain relatively high levels of uridine diphosphate sugar derivatives and UTP. In fat body, there is evidence for a phosphagen. Phosphorylethanolamine, phosphorylcholine, and glycero-phosphorylcholine are abundant in fat body, accumulating to high levels during prolonged diapause. (Auth.)

442 Hildreth, P.E., Lucchesi, J.C. LOW INCIDENCE OF POLYSPERMY IN Drosophila melanogaster AND Drosophila virilis. (Abstr.). Genetics 47, 8 (1962) 958-9.

Contrary to the widespread belief that polyspermy is a normal characteristic of fertilization in Drosophila, evidence was obtained indicating that, as a rule, only one sperm is present per fertilized egg in the two species investigated. Feulgen-stained whole mounts of freshly laid eggs were examined. In D. melanogaster, 96 eggs were found in meiotic stages; among these, 91 had a single sperm, 2 had 2 sperms, and 3 had no visible sperm. Among 127 eggs of D. virilis, 87 eggs had a single sperm, no sperm was visible in 40 eggs, and no case of polyspermy was observed. The possibility was investigated that soon after their alleged entry into the egg, the supernumerary sperms undergo some degenerative change which prevents their detection with the Feulgen technique. Drosophila melanogaster eggs, fertilized by H-thymidine labelled sperms, were collected; these eggs were sectioned, stained with Feulgen or Azur-eosin Giemsa, and processed for autoradiography. 40 eggs have been examined so far; the autoradiographic data also indicate that polyspermy is a rare event in D. melanogaster.

443 Hildreth, P.E., Lucchesi, J.C. FERTILIZATION IN Drosophila. I. EVIDENCE FOR THE REGULAR OCCURRENCE OF MONOSPERMY. Devl. Biol. 6, 2 (1963) 262-78.

Feulgen-stained whole mounts of D. melanogaster and D. virilis meiotic eggs, and serially sectioned eggs of D. melanogaster stained with Feulgen or with azur-eosin-Giemsa were examined. No polyspermy

was observed among 87 fertilized eggs of D. virilis; among 165 fertilized eggs of D. melanogaster, only 6 were found to be dispermic. An autoradiographic series in which we combined tritiated thymidine labelling and Feulgen staining of sperm fully supported the validity of the Feulgen technique as a means of determining the degree of polyspermy in Drosophila. In this series each sperm was found to be Feulgen positive and also labelled. Nineteen of 20 eggs examined were monospermic, one was dispermic. A survey of the literature dealing with insect fertilization has led us to conclude that in a large number of insect species (1) physiological polyspermy does not occur and (2) when accessory sperm do occassionally enter the egg, pathological effects of polyspermy need not be manifested. The reaction to polyspermy of these species should be considered as separate from Type I Inhibition (found in those eggs in which polyspermy is pathological) and from Type II Inhibition (found in those eggs in which polyspermy is physiological). We propose to name this reaction Type III Inhibition, with the stipulation that it does not involve a new kind of inhibitory process against polyspermy, but simply combines features of the other two types of inhibition. (Auth.)
Also published as UCRL-10538, California Univ., Berkeley. Lawrence Radiation Lab. Nov. 2, 1962, 21pp.

444 Hutchinson, P.B., Matthews, R.E.F. THE FATE OF TURNIP YELLOW MOSAIC VIRUS IN THE NON-VECTOR APHID Hyadaphis brassicae (L.). Virology 20, 1 (1963) 169-75.

A method is described for the artificial feeding of individual aphids. The stylets are placed in the bore of a small capillary tube, and the aphid is effectively immobilised in this position by securing its legs to the outside with wax. By using purified solutions of turnip yellow mosaic virus heavily labelled with P^{32} and S^{35}, it was shown that the virus enters the gut of the non-vector insect Brevicoryne (Hyadaphis) brassicae (L.) and that substantial quantities of apparently intact virus persist in the gut for periods of days. (From RAE-A 52: 1964, 318)

445 Iltis, W.G., Zweig, G. SURFACTANT IN APICAL DROP OF EGGS OF SOME CULICINE MOSQUITOES. Ann. ent. Soc. Amer. 55, 4 (1962) 409-15.

The apical drop found on the posterior end of eggs of species of Culex and Culiseta, described in the recent literature as being water, exhibit high surface activity and chemically seems to be an ester of several fatty acids. The apical drop appears to play a role in returning upset egg rafts to their normal position on the water surface. No phosphorus, i.e. phospholipids, could be detected in experiments on C. tarsalis allowed to feed on P^{32}-labelled chicken ($Na_2P^{32}O_4$) or sucrose solution containing $Na_2P^{32}O_4$ (10 μc/ml).

See also:

30 Water and food relationship of the eggs and first instar nymph of Eurygaster integriceps with the aid of P^{32}. (Quraishi, 1963)

I-C Insect Labelling

446* Андреев, С.В., Молчанова, В.А., Мартенс, Б.К. ПРИМЕНЕНИЕ РАДИОАКТИВНЫХ ИЗОТОПОВ ДЛЯ МАРКИРОВКИ НАСЕКОМЫХ. Защ. Раст. 2 (1960) 45-7.

Andreev, S.V., Molchanova, V.A., Martens, B.K. USE OF RADIOISOTOPES FOR LABELLING INSECTS. Zashch. Rast. 2 (1960) 45-7.

447 Андреев, С.В., Молчанова, В.А., Мартенс, Б.К., Ракитин, А.А. ПРИМЕНЕНИЕ РАДИОАКТИВНЫХ ИЗОТОПОВ ПРИ МАРКИРОВКЕ ВРЕДНОЙ ЧЕРЕПАШКИ Eurygaster integriceps Put. Энт. Обозр. 42, 1 (1963) 37-46.

Andreev, S.V., Molchanova, V.A., Martens, B.K., Rakitin, A.A. USE OF RADIOACTIVE ISOTOPES FOR TAGGING OF Eurygaster integriceps Put. (HEMIPTERA, PENTATOMIDAE). Ent. Obozr. 42, 1 (1963) 37-46.

448* Бабенко, Л.В. ПРИМЕНЕНИЕ РАДИОАКТИВНЫХ ИЗОТОПОВ ДЛЯ МЕЧЕНИЯ КЛЕЩЕЙ. Мед. Паразит. 29, 3 (1960) 320-4.

Babenko, L.V. THE USE OF RADIOACTIVE ISOTOPES FOR LABELLING TICKS. Med. Parazit., Moscow 29, 3 (1960) 320-4.

Ecological observations on ticks with a development cycle lasting several years sometimes involve recording the same individuals in successive stages of development. A labelling method that was applied to Ixodes ricinus (L.) is described. Radioactive carbon (C^{14}) was introduced intraperitoneally as a glycine constituent into mice and a rabbit at times when larvae and nymphs of I. ricinus were engorging on them. The ticks were rendered radioactive and were still so after the next moult: the cast skins were also radioactive. The process did not affect the ticks adversely.

449* Chatterji, S., Rahalkar, G.W., Sethi, G.R., Saxena, P.N. LABELLING OF ADULTS OF Bracon brevicornis WESMAEL WITH RADIOACTIVE PHOSPHORUS. Indian J. Ent. 22, 3 (1960) 226-30.

Experiments were carried out to label adults of B. brevicornis with radioactive P. By rearing the parasites on the full-grown caterpillars of Corcyra cephalonica, made radioactive by allowing them to feed on a crushed Jowar mixed with $H_3P^{32}O_4$, radioactive adults could be obtained. The activity in the adults was lost through egg-laying and excretion. (CA 56: 1962, 13364i)

450* Cook, L.M., Kettlewell, H.B.D. RADIOACTIVE LABELING OF LEPIDOPTEROUS LARVAE: A METHOD OF ESTIMATING LATE LARVAL AND PUPAL MORTALITY IN THE WILD. Nature, Lond. 187 (1960) 301-2.

Late larval and pupal mortality was estimated in 2 different colonies of the moth Panaxia dominula (L.) at different times (1953, 1959), suggesting figures between 85% and 95%. In 1953 (Kettlewell), larvae were fed on S^{35}-labelled deadnettle (Lamium spp.), giving > 20 cpm. In the larva S^{35} was mostly internal whereas in adults it was concentrated in the wings. Labelled insects were clearly distinguishable from non-radioactive ones, the lowest count being 76 cpm above background, and marked larvae could also be recognized easily. Adults were captured as they emerged, scanned, marked with cellulose paint (one mark per capture) and released. The adults were found to lay about 200 eggs (approximately 100/individual). The population under consideration comprised 6000-8000 individuals in 1952 so that the number of larvae remaining at the time of sampling was only $\sim \frac{1}{4}$ of the total number of eggs produced. There is thus heavy mortality in the late stages of development, after an appreciable drop in numbers has already taken place. The radioisotopes technique used permits estimates which are sufficiently accurate for a thorough study of mortality in wild populations.

451* Dobson, R.M. MARKING TECHNIQUES AND THEIR APPLICATION TO THE STUDY OF SMALL TERRESTRIAL ANIMALS. p. 228-39 in "Progress in Soil Zoology. Papers from a Colloquium on Research Methods Organized by the Soil Zoology Committee of the International Society of Soil Science, Rothamsted, Experimental Station, Hertfordshire, 10-14 July 1958". Murphy, P.W., Ed. London, Butterworths. 1962.

The uses of marking, also in quantitative studies, and of marking systems are reviewed. Radioactive materials for insect labelling are discussed on p. 233-4 and are amply documented. Attention is also drawn to possible harmful effects of the various kinds of marking.

452 Fay, R.W., Baker, J.T., Kilpatrick, J.W. REARING AND ISOTOPIC LABELING OF Fannia canicularis. J. econ. Ent. 56, 1 (1963) 69-71.

With an initial stock of 3000 pupae and weekly additions of 1000 pupae, a colony of the little housefly, Fannia canicularis (L.), provided 8000 to 10 000 eggs/d. Cultures of 1000 eggs yielded 35% pupae and 70% adult emergence with equal sex distribution. Using milk containing 2.5 mc of P^{32}/l as the only food source for 24 h, adult flies gave net counts of 675 to 1375 cpm at 8 to 10 d, and were considered to be labelled satisfactorily for field dispersion studies. (Auth.)

453 Kansu, A. LABELLING METHODS OF INSECTS WITH RADIOISOTOPES. University of Ankara Yearbook of the Faculty of Agriculture 1962 (1963) 11-12. (In English).

Review article. Mechanical labelling methods (external - sticking, dipping, painting, spraying; internal - injection, insertion) and biological labelling methods (contamination of food - feeding radioactive solutions, plant and animal mediation methods: contamination of the medium) are discussed. The selection of the isotope is determined by such factors as its half-life, biological and effective half-lives, the type of emission, energy and specific activity available, and the toxicity of the label.

454* Худадов, Г.Д. РАДИОАВТОГРАФИЧЕСКИЙ МЕТОД ОБНАРУЖЕНИЯ НАСЕКОМЫХ И КЛЕЩЕЙ, МЕЧЕННЫХ РАДИОАКТИВНЫМИ ИЗОТОПАМИ. Мед. Паразит. 28, 1 (1959) 60-4. Р. Ж. Биол. №50898.1960.

Khudadov, G.D. A RADIOGRAPHICAL METHOD OF OBSERVING INSECTS AND MITES LABELLED WITH RADIOACTIVE ISOTOPES. Med. Parazit., Moscow 28, 1 (1959) 60-4. R. Zh. Biol. No.50898. 1960.

When radioactive isotopes are used in the labelling of arthropods - the radioautography method is more convenient, more reliable and less laborious than the radiometry method. Calculations are given for determining exposures insuring the preparation of clear autoradiograms with a given isotope (Ca^{45}, Fe^{59}, I^{131} or P^{32}). (BA 45: 1964, 31730)

455 Худадов, Г.Д. АППАРАТ ДЛЯ МЕЧЕНИЯ ЧЛЕНИСТОНОГИХ ПОСРЕДСТВОМ НАНЕСЕНИЯ НА НИХ РАДИОАКТИВНЫХ ИЗОТОПОВ. Бюлл. Моск. Общ. Испыт. Прир., Отд. Биол. 66, 3 (1961) 40-50.

Khudadov, G.D. AN APPARATUS FOR ARTHROPOD LABELING BY MEANS OF SPRAYING THEM WITH RADIOACTIVE ISOTOPES. Byull. mosk. Obshch. Ispyt. Prir., Otd. biol. 66, 3 (1961) 40-50.

A special apparatus is described, designed for simple and reliable spraying and tagging of arthropods by means of aqueous solutions of radioisotopes. No preliminary anaesthetization is required; 200-300 arthropods can be labelled in 2-3 min. During the first few days following labelling there is a rapid drop in radioactivity which then levels out. Wetting does not cause insects to lose their label. Fleas, cockroaches (P^{32}, Rb^{86}, Sr^{89}), and flies (Musca domestica: P^{32}, Rb^{86}, Cd^{115}, Y^{91}, Sr^{90}, Ba^{140}, I^{131}, K^{45}) have been labelled with various radioisotopes. Best results were obtained with β-emitters of a medium energy ≥ 0.8 MeV.

456 Kurihara, T. RADIOACTIVE TAGGING OF Culex pipiens WITH P^{32}. Jap. J. sanit. Zool. 14, 1 (1963) 16-19.

457* Минго-Перес, Э., Сопрунов, Ф.Ф., Рискина, Л.П. О ПРИМЕНЕНИИ РАДИОИЗОТОПОВ ДЛЯ МАРКИРОВКИ МУХ. Мед. Паразит. 27, 1 (1958) 688-93.

Mingo-Perez, E., Soprunov, F.F., Riskina, L.P. THE USE OF RADIOISOTOPES FOR LABELLING FLIES. Med. Parazit., Moscow 27, 1 (1958) 688-93.

The rate of radioactive decay in flies was studied under field and laboratory conditions, following labelling with P^{32} ($NaH_2P^{32}O_4$), S^{35} (labelled methionine) and Fe^{59} (labelled chloride). In the laboratory, labelling was effected by feeding with labelled (30-108 μc/3.5 ml) sugar solution. In the field, breeding places (refuse bins) were treated with aqueous solutions (200 μc/2 l). Flies were trapped once a week within a 300 m radius. Experiments continued from 3 weeks to 2½ months. Flies hatching at treated sites remained radioactive for 2½ months. A positive correlation was found between the number of newly hatched and radioactive flies. The significance of the biological half-life of the radioisotopes employed is stressed, since radioactivity dropped much more rapidly than could be accounted for by normal decay.

458 Mortreuil, M., Brader, L.M. MARQUAGE RADIOACTIF DES FOURMIS DANS LES PLANTATIONS D'ANANAS. p.39-43 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

La méthode de marquage radioactif convient parfaitement pour étudier certains aspects structuraux des associations fourmis-cochenilles (Pheidole megacephala (F.) et Pseudococcus brevipes) dans les plantations d'ananas. L'apport original des radiotraceurs réside dans le fait qu'ils permettent, à l'encontre des méthodes habituelles, de visualiser sans ambiguïté et sans perturber l'équilibre écologique et démographique, les dimensions des nids et des territoires tenus sous leur dépendance. (Aut.)

459 Новокрещенова, Н.С., Солдаткин, И.С., Денисенко, Л.К., Мартенс, Л.А. ПРИМЕНЕНИЕ РАДИОАКТИВНОГО УГЛЕРОДА ДЛЯ МЕЧЕНИЯ БЛОХ. Мед. Паразит. 30, 1 (1961) 72-6.

Novokreshchenova, N.S., Soldatkin, I.S., Denisenko, L.K., Martens, L.A. USE OF RADIOACTIVE CARBON FOR THE LABELLING OF FLEAS. Med. Parazit., Moscow 30, 1 (1961) 72-6.

Fleas (Xenopsylla cheopis) were labelled with C^{14} by means of glycine or acetic acid. This was done either via the rodents' blood, with the flea feeding on it, or by direct topical application to the flea. Autoradiography was deemed most suitable for the detection of labelled fleas. When fleas were allowed to feed on mice which had been given C^{14} in a dose of 600 μc/mouse, the fleas remained labelled for

5 months. Glycine produced heavier labelling here than did acetic acid. When the radioactive substance was applied to the flea's integuments the label could be detected for 2 months.

460 Odum, E.P., Golley, F.B. RADIOACTIVE TRACERS AS AN AID TO THE MEASUREMENT OF ENERGY FLOW AT THE POPULATION LEVEL IN NATURE. p.403-10 in "Radioecology. Proceedings of 1st National Symposium on Radioecology held at Colorado State University, Fort Collins, 10-15 September 1961". New York, Reinhold Publishing Corp. 1963.

Individual, population and metabolic labels by means of radioisotopes are distinguished at the ecological level. Some of the most promising uses are in studies of heterotrophs at the population level (see work with P^{32} on Lasius flavus, ref. 83). Excretion rates of radioactive tracers served as indices of energy flow. The advantages of using Zn^{65} are discussed, amongst them its 250-d half-life, its relatively slow biological excretion, and hard γ-emission. A variety of terrestrial and aquatic species were used, amongst them the insects Tenebrio molitor (adults and larvae) and Oncopeltus fasciatus, the milkweed bug (adults and nymphs). The effect of environmental temperature on the biological half-life of Zn^{65} in newly emerged Tenebrio adults (living at 10, 20, and 30°C) was tested. Excretion was consistently exponential, but the slopes varied greatly with temperature. Biological half-life was inversely related to temperature and roughly inversely proportional to expected metabolic rate at these temperatures. The excretion of assimilated Zn^{65} by egg-laying Oncopeltus is shown graphically, with large loss via the eggs and little by other means. - Excretion rate increased greatly in 2 male Oncopeltus when released out of doors. - I^{131} proved a better indicator of moulting (Tenebrio), Zn^{65} of egg laying.

461 Quraishi, M.S., Lamsachi, R.F., Ergül, C. LABORATORY STUDIES ON TAGGING OF Anopheles stephensi. J. econ. Ent. 56, 5 (1963) 672-4.

Satisfactory levels of radioactivity (ca. 4000 cpm for males and 5000 cpm for females) were obtained in adult A. stephensi Liston by rearing 500 4th-instar larvae in 1 litre of water containing 10 μc of P^{32}. Sufficient activity was thus obtained in the adult to permit their detection one month after release. The behaviour of the adults appears in no way to be affected by the isotope. To obtain a good adult yield in a desired period of time (3-5 d after radioactivation of the larvae), it was found necessary to select larvae of uniform size with the aid of a mechanical separator. Larvae passing between 1.20 mm and 1.35 mm openings were accepted.

462 Шура-Бура, Б.Л., Харламов, В.П. ПРИМЕНЕНИЕ РАДИОАВТОГРАФИИ ДЛЯ ВЫЯВЛЕНИЯ МАРКИРОВАННЫХ РАДИОАКТИВНЫМИ ИЗОТОПАМИ ЧЛЕНИСТОНОГИХ. Стр. 28-9 в сб. "Материалы Симпозиума по применению биофизики в области защиты растений". Л. 1961.

Shura-Bura, B.L., Kharlamov, V.P. THE USE OF RADIOAUTOGRAPHY FOR THE DETECTION OF ARTHROPODS LABELLED WITH RADIOACTIVE ISOTOPES. p.28-9 in "Materials of the Symposium on the Use of Biophysics in the Field of Plant Protection". Leningrad, 1961.

Labelling with radioisotopes is a useful method for studying the movements of arthropod vectors of disease, and the labelled organisms can be detected by radiometry or by radioautography, which is simpler, since the organisms (or parts of them) are merely exposed on an ordinary photographic film for 24-72 h in a simple apparatus. By this method, Xenopsylla cheopis (Roths.) and Nosopsyllus (Ceratophyllus) fasciatus (Bosc) were shown to retain P^{32} and Sr^{89} for 1 and 3 months, respectively. The fleas were labelled by feeding them on mice which had received 4 μc/g body weight. (From RAE-B 51: 1963, 212)

463 Sullivan, C.R. THE SURVIVAL OF ADULTS OF THE WHITE PINE WEEVIL, Pissodes strobi (Peck), LABELLED WITH RADIOACTIVE COBALT. Canad. Ent. 93, 1 (1961) 78-9.

Co^{60} (as cobalt nitrate in acetone) was mixed with a de Kotinsky cement-benzene solution. The mixture adhered firmly to the insect elytra. The tags are suitable for behavioral studies on dispersal. For short periods (1-2 months) survival is not seriously affected by tags containing ~250 μc or less; such tags are easily detectable at distances of about 15 feet with a portable Geiger radiation probe. For period of 9 months or more tags must be limited to about 50 μc of Co^{60}; they are still readily detectable at about 5 feet.

464 Tahmisian, T.N., Devine, R.L. PRELIMINARY EXPERIMENTS ON LABELING OF GRASSHOPPER SPERMATOGONIA WITH TRITIATED THYMIDINE. p.192-3 in "Biological and Medical Research Division". Semiannual Report, July - December 1962. ANL-6790, Argonne National Lab., Ill.

Preliminary experiments include autoradiographic studies to establish the period(s) of isotope uptake, and whether grasshopper spermatogenesis is cyclic, as in mammals. (The electron microscope is to be used for studying possible deleterious effects of the H^3-labelled thymidine). Injections of 5 μc (1 μc/μl) of aqueous H^3-thymidine were tolerated by the grasshoppers which did not, however, survive > 10 μc. Labelling was found to occur randomly in several spermatogonic cysts of a testicular follicle. Sections were exposed for ~2 weeks for autoradiography.

See also:

12 Some recent studies, involving the use of radioisotopes, of the feeding behaviour of two phytophagous insects. (Banks, 1962)

13 Field studies of the daily activity and feeding behaviour of Sunn pest, Eurygaster integriceps Put., (Hemiptera, Scutelleridae) on wheat in North Iran. (Banks et al., 1961)

35 Sur la transmission d'isotopes radio-actifs entre deux fourmilières d'espèces différentes (Formica rufa et Formica polyctena). (Chauvin et al., 1961)

47 A study on formation and transmission of glandular secretions in Formica (Hymenopt. Formicidae) by means of a radioisotope technique. (Naarman, 1963)

48 L'abeille et la radioactivité. (Nordau, 1962)

51 Use of P^{32} as an aid in biological studies of the leafhopper, Scaphoideus luteolus. (Hay and Myser, 1961)

54 Mating behaviour of Anopheles stephensi. (Quraishi and Arthur, 1963)

56 The role of radionuclides in insect behavior studies (Schmidt and Smith, 1963)

63 Some results of the use of tracer techniques in the study of plant protection. (Andreev et al., 1958)

65 Studies on the flight habits of some marked insects. (Eddy et al., 1962)

79 The use of radioactive phosphorus to follow the movement of the black currant gall mite. (Lloyd-Jones and Smith, 1961)

83 Population density of the underground ant, Lasius flavus, as determined by tagging with P^{32}. (Odum and Pontin, 1961)

87 Preliminary studies on the field movement of the olive fruit fly (Dacus oleasea (Gmel.)) by labelling a natural population with radioactive phosphorus (P^{32}). (Pelekassis et al., 1962)

88 Preliminary studies of the field movement of the olive fruit fly (Dacus oleae (Gmel.)) by labelling a natural population with radioactive phosphorus (P^{32}). (Pelekassis et al., 1963)

89 The use of radioisotopes in the marking of Eurygaster integriceps Put. (Rakitin, 1963)

95 Etude du vagabondage de Ceratitis capitata Wied. en Tunisie à l'aide de radio-isotopes. (Soria and Cline, 1959)

96 Etude des populations et de dispersion de Ceratitis capitata Wied. (Dipt. Trypetidae) en Tunisie à l'aide des radioisotopes. (Soria, 1963)

137 The use of radioisotopes in the study of helminth life cycles. (Dissanaike, 1962)

138 Use of the radioisotope of phosphorus for labelling graminivorous Noctuidae and their parasites. (Karnenkova and Molchanova, 1962)

139 Autoradiography as a method of detecting tagged rodents and their ectoparasites in a study of migration problems. (Shura-Bura and Kharlamov, 1961)

140 Application of radioactive isotopes to the study of some problems of flea ecology. II. The contact between rodents and the degree to which ectoparasites are interchanged in a population of Rhombomys opimus. (Sviridov, 1963)

152 Studies on the phosphorus-32 uptake in Schistocerca gregaria (Forsk.) and Anacridium aegyptium (L.). (Abdel-Malek and Abdel-Wahab, 1961)

168 Distribution of zinc-65 in the wasp, Habrobracon, and its effects on reproduction. (Grosch, 1962)

174 Excretion rate of radio-isotopes as indices of metabolic rates in nature; biological half-life of zinc-65 in relation to temperature, food consumption, growth and reproduction in arthropods. (Odum, 1961)

445 Surfactant in apical drop of eggs of some culicine mosquitoes. (Iltis and Zweig, 1962)

476 Certain biological effects produced in the boll weevil by tagging it with P^{32}. (Mayer and Brazzel, 1961)

482 Use of radioactive isotopes for the labelling of epidemiologically important arthropods. (Khudakov, 1959)

484 Etude sur la biologie de Mallophaga. I. Emploi de l'isotope ^{59}Fe pour déterminer la nature des aliments du pou de la poule. (Kalamarz, 1963)

489 Studies on the character and prevention of the virus disease of garden crops. II. Studies on the mechanism of aphid transmission of mosaic disease of Japanese radish, using radioactive phosphorus. (Nishi, 1959)

490 Studies on the varietal resistance of garden crops to the virus disease. V. On the course of aphids transmission of the mosaic disease of Japanese radish determined by P^{32} or S^{35} (1). (Nishizawa et al., 1958).

491 Studies on the mechanism of aphid transmission of mosaic disease of Japanese radish using radioactive phosphorus-32. (Nishizawa et al. 1959)

517 Drywood termite metabolism of Vikane fumigant as shown by labelled pool technique. (Meikle et al., 1963)

766 The application of nuclear energy to agriculture. (Boroughs, 1962)

782 The effect of ionizing radiation on the biology and ecology of Rhodnius prolixus, the principal vector of Schizotrypanum (i.e. Trypanosoma) cruzi in Venezuela. (Gomez et al. 1962)

1546 Technical problems of radioisotope measurement in insect metabolism. (Kloft, 1962)

1452 Possibilities of eradication of the Mediterranean fruit fly Geratitis capitata Wied. from Central America by gamma-irradiated males. (Kattyar, 1962)

1468 Quelques effets des rayons gamma sur la teigne de la farine et sur divers nématodes. (Brande and Pelerents, 1962)

1580 Travaux de recherches utilisant les isotopes et les rayonnements nucléaires en entomologie appliquée en France et dans les pays associés. (Pesson, 1962)

I-D Developmental and Genetic Effects Incurred through Labelling

465 Abdel-Malek, A.A., Kevan, D.K. MCE. INHIBITED OVIPOSITION BY FEMALES OF Gryllus assimilis (F.) INDUCED BY RADIOACTIVE MALES, USING L-METHIONINE-METHYL-^{14}C. Nature, Lond. 192, 4803 (1961) 681-2.

Aqueous solutions of L-methionine labelled in the methyl group with C^{14} which emits weak β-rays, were injected into the haemolymph of last-instar nymphs of the Jamaican Gryllus assimilis (F.) at rates of 0.05 - 10 μc each. Doses above 5 μc were lethal within 24 h, but nymphs with up to 5 μc completed their development and functioned normally. No eggs were laid by females (whether radioactive or normal) when mated with radioactive males although oviposition by virgins or both kinds is normal. Oviposition recommenced on mating with normal males. About 2 weeks later, radioactive females produced radioactive eggs which resulted in radioactive 1st-instar nymphs. Similar results were obtained when drinking water contained some of the radioisotope. These findings provide the first indication that sterility can be induced by so weak a source. Some factor which appears to inhibit oviposition seems to be passed to the females from the radioactive males by way of the spermatophores, found to be detectably radioactive. It seems unlikely, at present, that non-radioactive L-methionine would have this effect. This type of sterility would not appear to be exploitable against G. assimilis by the release of radioactive males since the females mate frequently, and would soon do so with normal males.

466 Abdel-Malek, A.A. THE EFFECT OF RADIOACTIVE PHOSPHORUS ON THE GROWTH AND DEVELOPMENT OF Culex pipiens molestus Forsk. (DIPTERA, CULICIDAE). Bull. ent. Res. 52, 4 (1961) 701-8.

In a study of the effect of different concentrations of P^{32} in the larval medium on the growth and development of Culex pipiens molestus Forsk., P^{32} was found to have little noticeable effect on the growth of the larvae up to a concentration of 3.0 μc of P^{32} ml, but, above this concentration, larval growth was greatly retarded. The period of larval development was increased at concentrations greater than 1.0 μc of P^{32} ml, and pupation occurred 2 weeks later than in the controls. In concentrations higher than 5.0 μc/ml, pupation was completely inhibited, larvae became sluggish, stopped feeding and finally died. The effect of P^{32} in the larval medium on the emergence and radioactivity of the resulting adults was also studied. On the basis of this study, it is recommended that, for efficient utilisation of radiophosphorus in large-scale field experiments, a concentration of P^{32} of 1.0 μc/ml be employed so that emerging adult mosquitos may be sufficiently radioactive to be readily detectable. (Auth.)

467 Abdel-Malek, A.A. INHIBITORY EFFECT OF L-METHIONINE-METHYL-^{14}C ON OVIPOSITION BY FEMALES OF THE COTTON LEAF WORM, Prodenia litura (F.), INDUCED BY RADIOACTIVE MALES. Nature, Lond. 200 (1963) 604-5.

The radioactive solution (0.05-5.0 μc/insect) was injected into the haemolymph of newly emerged moths of both sexes of Prodenia by microsyringe ("Agla" brand), inserted laterally through the intersegmental

membrane between the 6th and 7th abdominal segments. These moths were then allowed to associate with controls (same age and stock) as follows: radioactive males with normal females; radioactive females with normal males; and normal females with normal males. Oviposition occurred only after radioactive males had been removed, when sterile eggs were laid 2 d later. Doses up to 1 μc had no deleterious effects on the moths. L-methionine-methyl-C^{14} appears to produce sterility in the male moth which has some (inhibitory?) effect on the female, so as to block oviposition altogether. The addition of radioactive males in the ratio of 12:1 to a normal population would prevent oviposition. The mass production of such males would, however, prove extremely laborious.

468 Erdman, H.E. EFFECTS OF Sr^{89} UPON POPULATIONS OF MEAL MOTHS. p.31-4 in "Hanford Biology Research Annual Report for 1960". HW-69500, General Electric Co. Hanford Atomic Products Operation, Richland, Wash. 10 Jan. 1961.

Populations of Ephestia, the Mediterranean flour moth, were cultured on cornmeal spiked with different concentrations of Sr^{89}. Several fitness components were measured to illustrate how insect populations react when irradiation is a chronic environmental factor. All levels of S^{89} employed in this experiment were detrimental to the developing organisms; those which attained adulthood reproduced another generation even though reduced in numbers. (Auth.)

469 Erdman, H.E. EFFECTS OF INGESTED Pu^{239} ON FECUNDITY, FERTILITY AND LIFE SPAN OF Habrobracon (HYMENOPTERA: BRACONIDAE). HW-SA-2605, General Electric Co. Hanford Atomic Products Operation, Richland, Wash. 8 June 1962. 10p.

See 470.

470 Erdman, H.E. EFFECTS OF INGESTED Pu^{239} ON FECUNDITY, FERTILITY AND LIFE SPAN OF Habrobracon (HYMENOPTERA: BRACONIDAE). Hlth Phys. 8, 6 (1962) 635-8.

Adult virgin female wasps, Habrobracon juglandis, were fed a single meal adulterated with either, 0.64, 0.16, or 0.08μc Pu^{239}/mg citrate-buffered sugar solution. Effects on fecundity, fertility, and life span were studied. The high concentration of the ingested isotope induced sterility after the 3rd day and lethality by the 8th day. The medium concentration induced temporary sterility (7th and 8th days), indicative of the radiosensitive developing egg-nurse cell syncytia in the zone of differentiation. The low concentration failed to induce sterility but reduced fecundity. Fertility, although noticeably reduced after the 6th day, increased to initial values toward the end of the experiment. Chromosomal damage is suggested to account for the differential radiosensitivity of germ cells in various stages of oögenesis. (Auth.)

471 Erdman, H.E. EFFECTS OF IRRADIATION ON THE MEDITERRANEAN MEAL MOTH Ephestia kuehniella Zeller, CULTURED ON ^{89}Sr-SPIKED FOOD. Int. J. Rad. Biol. 5, 4 (1962) 331-8.

Ephestia kuehniella Zeller was cultured on corn-meal spiked with Sr^{89} at concentrations of 0, 0.1, 0.3, 1.0, 3.0 and 5.0 μc/g of food. As the environmental radiation was increased, the adults which were subjected throughout their life-cycle produced progressively fewer progeny. 5.0 μc Sr^{89}/g food approaches the critical level which will inhibit population development. Life-span of the adults was not influenced by the experimental conditions. Delayed development occurred at all isotopic concentrations employed. The radiostrontium-content of females at the end of their life-cycle was half that of males. 24 h after eclosion, the radioactivity of the female moth was equal to, or greater than, that of corresponding males. Reproductive metabolism is offered in explanation. At the 2 highest culture levels (3 and 5 μc Sr^{89}/g), the increased number of males (homogametic sex) over females (heterogametic sex) is consistent with the radiation genetic effect of induced recessive lethals. No selective radiation effect upon the sexual capacity of gametes of the F_1 was indicated, since the subsequent F_2 sex ratio was 1:1. (Auth.)

472 Grosch, D.S. THE GENETIC AND DEVELOPMENTAL EFFECTS OF INGESTED RADIOACTIVES IN Habrobracon. ORO-378, North Carolina State College, Raleigh. 1960.

Larvae and adults of both sexes were used. The P^{32} mixture proved most deleterious when fed to adult females because it induced infecundity and sterility. Effects are traceable to 60% of a dose passing through the ovaries via egg incorporation. Although delayed development, abnormalities, and lethality can be correlated with the radioactivity of the larval food exact quantitation proved difficult. The low probability of recovering visibles in the presence of drastic lethality was another complication. The life span of fed adults was also used to reveal gross physiological damage. S^{35} and Ca^{45} only reduced differentiation and hatchability of the most sensitive cell types. A descending order of effectiveness of the isotopes was

revealed corresponding to the ascending order of their physical half-lives. Relatively brief biological half-lives complicated the comparison of alkaline earth elements with other isotopes although in all cases altered egg production had a greater influence than hatchability on the number of live offspring obtained. Sr^{89} caused temporary and permanent infecundity and sterility. Radiation intensity and the effects of some chemical features of the physiological environment are also considered. The biochemical basis of restoration is attacked. Attention is paid to antimetabolites, and the effects of inorganic ions on reproductive capacity.

473 Hughes, A.M. FURTHER STUDIES OF THE EFFECTS OF DEUTERIUM AND TRITIUM ON Drosophila. p.118-9 in "Bio-organic Chemistry. Quarterly Report, September - November 1961". UCRL-10032, California. Univ., Berkeley. Lawrence Radiation Lab. 25 Jan. 1962.

A statistically significant increase in the number of unusual progeny from D_2O-treated males over control males of D. melanogaster was found consistently. Suggestions that part of the D_2O-effect might be due to the relatively high tritium content of some of the D_2O stock solutions were not substantiated by experiments in which controlled amounts of tritium were added to D_2O. However, tritium alone caused the occurrence of a mutant in two consecutive experiments. (NSA 16: 1962, 18804)

474 Kaplan, W.D., Tinderholt, V.E., Gugler, H.D., Kidd, K.K. A NON-RANDOM DISTRIBUTION OF LETHALS INDUCED BY TRITIATED THYMIDINE IN Drosophila melanogaster. (Abstr.) p.227 in "2nd International Congress on Radiation Research, Harrogate, Yorkshire, England, 5-11 Aug. 1962". London, Silver End Documentary Publications, Ltd., 1962. *

The mutagenic action of tritiated thymidine has already been reported (Experientia 16: 1960, 67). Additional studies of induced mutations have been carried out in two ways: feeding of larvae and injection of imagoes. Autoradiographs of testes of treated males and the seminal receptacles and spermathecae of females mated with them have shown that the broods in which observed mutation rates have been found correspond with the labelled sperm generations. Sex-linked recessive lethals induced by the treatment have been located and their distribution along the X-chromosome appears to be distinctly non-random.

* Fully reported in April issue of Genetics, 1964.

475 Kaplan, W.D., Gugler, H.D., Kidd, K.K. THE GENETIC EFFECTS OF LABELED DNA PRECURSORS. (Abstr. 5.33). p.66 in "Genetics Today. Proceedings of XI International Congress of Genetics. The Hague, September 1963. Vol.I". Geerts, S.J., Ed. Oxford, Pergamon Press, 1963.

Sex-linked recessive lethals have been induced in Drosophila males by feeding tritiated thymidine to larvae. In three experiments feeding was restricted to 8 h to limit the incorporation of the isotope. The most heavily labelled germ cells appeared in the brood sperm utilized for the first of three 3-d broods tested for induced lethals. In one experiment, during which larvae were permitted to feed on labelled food throughout larval life a higher frequency of labelled sperm bundles was obtained and also heavier labelling of individual sperm. Induced mutation rates reflected the degree of incorporation, and mutations were restricted to those broods with labelled sperm. The physical characteristics of the β emissions of tritium - low energy and short mean path - led us to test the distribution of the induced mutations. The pattern is non-random and differs significantly from those obtained by the use of x-irradiation. The region of the X-chromosome from 1 to 20 is relatively free of mutations, whereas the regions between 30-35, 50-55, and 60-65 have a higher number of induced lethals than would be expected at random. Mutations have also been induced by tritiated deoxycytidine. These mutants will be localized and the distribution compared to the one observed with H^3-thymidine. If the pattern of induced mutations reflects the varying frequencies of the pyrimidine bases along the length of the chromosome, the pattern induced by H^3-deoxycytidine should differ from that observed with the use of H^3-thymidine.

476 Mayer, M.S., Brazzel, J.R. CERTAIN BIOLOGICAL EFFECTS PRODUCED IN THE BOLL WEEVIL BY TAGGING IT WITH P^{32}. J. econ. Ent. 54, 6 (1961) 1197-1203.

Boll weevils (Anthonomus grandis Boheman) were tagged with P^{32} by feeding to adults in solutions or rearing them in larval diets to which $H_3P^{32}O_4$ had been added in varying quantities. The rates of loss of radioisotope were higher for those weevils fed P^{32} as adults than for the weevils reared on the radioactive larval diet. Studies of the effects of P^{32} on fecundity, longevity, lengths of oviposition and pre-oviposition periods disclosed that the weevils reared from radioactive larval diet were more adversely affected than the weevils fed as adults. Females reared from the two highest dosages in the diet failed to lay eggs.

Larval mortality increased in proportion to the amount of radioactivity in the diet, and mortality was always greater and began sooner for the weevils reared in radioactive larval diet. (Auth.)

477 Strømnaes, Ø. MUTAGENIC EFFECT OF C^{14} AND H^3 LABELLED DNA*-PRECURSORS INJECTED INTO Drosophila melanogaster MALES. Canad. J. Genet. Cytol. 4 (1962) 440-6.

Four groups of D. melanogaster males were injected with C^{14}- and H^3-labelled DNA precursors. In one group the males were injected as larvae. In 3 other groups and in a control group all males were injected 6 to 24 h after emergence from the pupal case. In the control group a non-labelled DNA precursor was used. Dominant lethals measured as the frequency of non-hatched eggs seemed not to be induced by the amount of radioactivity used. There was, however, a significant increase in the frequency of sex-linked recessive lethals. The data suggest that sperm available for insemination 12 to 13 d after injection have the highest induced mutation rate. The frequency of induced dominant lethals was not raised above the control value by the same radioactive compounds, and there were no indication of brood differences.

* deoxyribonucleic acid

478 Strømnaes, Ø., Kveiland, I. THE INDUCTION OF MINUTE MUTATIONS IN Drosophila WITH TRITIUM-LABELED THYMIDINE. Genetics 48 (1963) 1559-65.

D. melanogaster adult males were injected with tritium-labelled or unlabelled thymidine when 1 to 24 h old. 1½ d later they were mated to a series of females, to sample sperm delivered over successive three-day periods, furnishing six 3-d broods. The injected males in the labelled series were less viable and fecund than those in the control series. The 6th brood in the labelled series had a significantly higher frequency of minutes than any other brood in either series and had the lowest frequency of wild-type males. The frequency of mosaic females and of phenotypic hemithorax flies was significantly higher in the labelled series than in the control series. (Auth.)

479 Walen, K.H. CYTOGENETIC STUDIES OF X-RAY AND INGESTED P^{32} INDUCED SEX-LINKED RECESSIVE LETHALS IN Drosophila melanogaster. Hereditas 48 (1962) 124-31.

A comparative study was made of equal numbers of sex-linked lethals induced by ingested P^{32} or x-irradiation of males of D. melanogaster. Peak production of lethals coincided within each experimental series with the period of maximum chromosome breakage. The relationship between DNA synthesis and the time of chromosome breakage was discussed. Chromosomal aberrations: deletions, translocations and inversions were recovered following treatment with either mutagen. The distribution of point mutation lethals induced on the X-chromosome by P^{32} is identical to the one found after x-ray treatment. Theories which can account for the unexpected recovery of exceptional males in cultures derived from mature sperm treatment have been discussed. (Auth. summary).

See also:

20 Hessian fly feeding studies utilizing radioisotope P-32. (Gallun and Langston, 1962)
21 Feeding habits of Hessian fly larvae on P^{32}-labelled resistant and susceptible wheat seedlings. (Gallun and Langston, 1963)
22 Determination of facts on supplementary feeding of insects with the aid of radioactive phosphorus and its effect on the maturing of eggs of Meniscus aguatus, a parasite of Hadena basilinea Sch. (Kamenkova and Molchanova, 1962)
69 Marking and release experiments with a tropical mosquito by the use of radioisotopes. (Gillies, 1962)
70 Studies on the dispersion and survival of Anopheles gambiae Giles in East Africa, by means of marking and release experiments. (Gillies, 1961)
168 Distribution of zinc-65 in the wasp, Habrobracon, and its effects on reproduction. (Grosch, 1962)
169 The localization, persistence and resultant genetic effects in invertebrates of ingested fourth period metals in stable and radioactive forms. (Grosch, 1963)
696 Radioisotope studies of pesticide metabolism by the pineapple plant. (Gortner, 1962)
970 Induction of chromosome aberrations in the spermatocytes of grasshoppers. (Ray-Chaudhuri, 1961)

I-E Insects as Disease Vectors for

I-E-1 MAN

480 Bruce-Chwatt, L.J. SOME ENTOMOLOGICAL PROBLEMS IN TROPICAL MEDICINE. p.211-29 in "Radioisotopes in Tropical Medicine, Proceedings of a Symposium, Bangkok, 12-16 December 1960". Vienna, International Atomic Energy Agency, 1962.

Review article. Malaria, African trypanosomiasis, arthropod-borne viruses and mite typhus have been selected as examples for showing the extraordinary complexity of the epidemiology of those tropical diseases in which an insect or an acarine acts as a vector. A knowledge of the ecology of the vector provides the main clue to the long-term planning of any methods of control or eradication of the relevant disease. The particular promise of radioisotopes as tools is emphasized for the following: (1) Ecological studies (dispersal range and seasonal movements; behaviour characteristics in relation to feeding, mating, oviposition and diurnal rhythmical activity; longevity studies; population density). (2) Epidemiological studies (physiology of the vector in relation to the pathogen; vectorial capacity). (3) Studies relevant to vector control (study of the normal physiology of disease vectors; study of the metabolism of vectors resistant to insecticides; study of biophysical control methods such as release of insects sterilized through the action of ionizing radiations).

481 Jenkins, D.W. RADIOISOTOPES IN ENTOMOLOGICAL STUDIES OF ENDEMIC AND TROPICAL DISEASES. p.235-62 in "Radioisotopes in Tropical Medicine, Proceedings of a Symposium, Bangkok, 12-16 December 1960". Vienna, International Atomic Energy Agency, 1962.

About 500 publications are reviewed on uses of atomic energy in the study and control of medically-important insects and their relation to human disease. The value and practicability of radioisotopes as a research tool is discussed with relation to epidemiological studies on dispersal, migration, life history, populations, and disease transmission by arthropod vectors. The use of atomic energy in control by insecticides, irradiation and sterilization, and natural control of the arthropods are reviewed, also the uses of radioactive materials vector-host relationships. Suggestions and recommendations for new and additional studies with radioisotopes and radiation are made for work in the field of endemic and tropical diseases. Co-ordinated use of irradiation, insecticides, special chemicals and hormones, special genetic characters, and natural control of pest and disease vector arthropods is suggested. Use of irradiation in learning the genetics of medically-important insects is a promising field that may provide sterile intersexes and hybrids, genes causing abnormal sex ratios, sterility factors, and other characters that may present new methods of insect control. Radioisotopes may also be used for ecological studies on parasite and predator control of such insects. (From auth.)

See also:

- 33 Experiments on studying the feeding activity of fleas parasitizing Gerbillinae under natural conditions by means of radioisotopes. (Soldatkin et al., 1962)
- 53 Use of isotopes for investigating the behaviour and ecology of insect pests in some recent studies. (Quraishi, 1963)
- 137 The use of radioisotopes in the study of helminth life cycles. (Dissanaike, 1962)
- 782 The effect of ionizing radiation on the biology and ecology of Rhodnius prolixus, the principal vector of Schizotrypanum (i.e. Trypanosoma) cruzi in Venezuela. (Gomez et al., 1962)

482* Худадов, Г.Д. ПРИМЕНЕНИЕ РАДИОАКТИВНЫХ ИЗОТОПОВ ДЛЯ МАРКИРОВКИ ЧЛЕНИСТОНОГИХ, ИМЕЮЩИХ ЭПИДЕМИОЛОГИЧЕСКОЕ ЗНАЧЕНИЕ. Докл. АН СССР (1959). Р.Ж. Биол. №50899 Д. 1960.

Khudadov, G.D. USE OF RADIOACTIVE ISOTOPES FOR THE LABELING OF EPIDEMIOLOGICALLY IMPORTANT ARTHROPODS. Dokl. Akad. Nauk SSSR (1959). R.Zh. Biol. No.50899 D. 1960.

I-E-2 ANIMALS

483 Bennet, G.F. USE OF P^{32} IN THE STUDY OF A POPULATION OF Simulium rugglesi (DIPTERA: SIMULIIDAE) IN ALGONQUIN PARK, ONTARIO. Canad. J. Zool. 41 (1963) 831-40.

To investigate the means by which blackflies transmit disease, P^{32}-labelling was explored. Flies were allowed to feed on ducks injected with 0.25 - 0.5 mc P^{32}. The radiation level in duck blood fluctuated for the first 28 h, then decreased until, after 186 h, the level was about 1/3 that at 1½ h. Preliminary trials indicated that ducks could be exposed to the biting activity of S. rugglesi at any time after isotope administration; 12 h were chosen for convenience. The blood volume ingested by flies at a meal was determined via the radioactivity acquired. The blood meal of 56 flies so measured averaged 1.94 (0.48 - 3.56) mm^3. The rate of loss of P^{32} from the flies exceeded that from natural decay. Presumably some loss may occur in the eggs at oviposition, as in Aëdes aegypti. Nearly double the isotope level would be required for future studies if a detectable level is to be maintained for > 30 d. S. rugglesi was shown to be a mobile, long-lived population, probably involving relatively few individuals. Taking into consideration the strong host and habitat preferences shown by this species, all factors would lead to a rapid and large building up of the infective stage of parasite (e.g. Leucocytozoon simondi) in the fly population.

484 Kalamarz, E. ETUDE SUR LA BIOLOGIE DE Mallophaga. I. EMPLOI DE L'ISOTOPE ^{59}Fe POUR DÉTERMINER LA NATURE DES ALIMENTS DU POU DE LA POULE. Zesz. Nauk. Wyz. Szkol. Rolnicz. Olszt. 15, 2 (1963) 247-51. (In Polish, with Russian, English and French summaries).

Le marquage du pou était effectué par voie d'injection intraveineuse de la poule avec du ^{59}Fe. L'autoradiographie était employée pour étudier les relations hôte-parasite et l'alimentation du pou qui se nourrit principalement du sang de poule.

See also:

1570 Use of radioisotopes and radiation in the control of plant and animal insect pests. (Andreev et al., 1963)

I-E-3 PLANTS

485 Japan. Kyushu Agricultural Experiment Station. Plant Pathology Lab., Fukuoka. STUDIES ON THE TRANSMISSION OF VIRUS DISEASE OF CROPS. 1. ECOLOGICAL AND THERAPEUTICAL STUDIES ON THE DWARF DISEASE OF RICE PLANTS - STUDIES ON THE TRANSMISSION OF DWARF DISEASE OF RICE PLANTS. Nucl. Sci. Abstr., Japan 1, 3/4 (1962) 99-100. (In English).

The relationship between the age of rice plants at the time of inoculation and the transmission of dwarf disease by green rice leafhopper, Nephotettix cincticeps Uhler, was investigated by means of P^{32}. After feeding for 24 h on diseased plants cultured in a solution containing P^{32}, the insects were transferred to healthy rice plants in the 1-6 leaf stage for a test feeding period of 24 h. P^{32} transfer was greatest on rice plants at the 2nd leaf stage. Infected leafhoppers were allowed to feed on 83 species of plants. Autoradiography showed that the leafhopper transferred P^{32} to 26 species. When the insects were allowed to feed on diseased rice plant which had been labelled with S^{35} via the roots, S^{35} was found to accumulate in the Malpighian tubules.

486 Japan. Kyushu Agricultural Experiment Station, Plant Pathology Lab., Fukuoka. ECOLOGICAL AND THERAPEUTICAL STUDIES ON THE VIRUS DISEASES OF GARDEN CROPS - STUDIES ON THE TRANSMISSION OF PLANT VIRUSES BY APHIDS. Nucl. Sci. Abstr., Japan 2, 2 (1963) 130. (In English).

An attempt was made to establish which plants were preferred hosts of the green peach aphid, Myzus persicae Sulzer, carrier of the Daikon mosaic virus. Aphids were allowed to feed for 24 h on virus-diseased radish seedling which had been labelled by root absorption of P^{32}. The aphids were then transferred to 29 species of plants for test feeding, the radioactivity of the plants being tested after 24 h of feeding (by GM-counters and autoradiography). Aphids were found to transfer P^{32} particularly to the following 13 plants: Calendula arvensis, Youngia japonica, Spinacia oleracea, Gomphrena globosa, Bellis perennis, Artemisia vulgaris, Raphanus sativus, Rorippa indica, Nicotiana tabacum, Viola tricolor var. arvensis, Dianthus superbus, Antirrhinum majus and Triticum aesticum. No P^{32} was transferred to Oryza sativa, Avena fatua, Digitaria adscendens, Datura stramonium, Salvia officinalis and Rosa hydrida.

487 Maramorosch, K. ACQUISITION AND TRANSMISSION OF ASTERS YELLOWS VIRUS. Phytopathology 52 (1962) 1219.

Virus acquisition by aster leafhoppers (Macrosteles fascifrons) was found related to the site of feeding on diseased aster plants. During a 16-h day at 25°C, only 3% of the leafhoppers acquired virus from older symptomless leaves of a diseased plant, whereas 80% acquired virus from diseased flowers and 90% from leafless stems. When leafhoppers were given free access to the entire plant or when they were caged on young diseased leaves, up to 50% acquired virus in a single day. Infective leafhoppers, transferred 32 times during a 16-h day at 25°C to 640 aster seedlings, infected only 78 plants in the 1st part of the day, but 162 plants in the 2nd part. Transmission peaks were observed at 8 and 11 a.m.; and at 3, 5 and 8 p.m. Although increased transmission during the afternoon hours coincided with increased feeding activity, as shown by uptake of C^{14}-labelled glucose, no definite peaks were found in food uptake. The observed transmission peaks may indicate the existence of an independent mechanism governing virus transmission. (Auth.)

488 Maramorosch, K. ARTHROPOD TRANSMISSION OF PLANT VIRUSES. Annu. Rev. Ent. 8 (1963) 369-414.

Detailed review article, concluded in June 1962. Some mention of work with radioisotopes is made (see especially p.381).

489* Nishi, Y. STUDIES ON THE CHARACTER AND PREVENTION OF THE VIRUS DISEASE OF GARDEN CROPS. II. STUDIES ON THE MECHANISM OF APHID TRANSMISSION OP MOSAIC DISEASE OF JAPANESE RADISH, USING RADIOACTIVE PHOSPHORUS. Proc. Ass. Plant Prot. Kyushu 5 (1959) 24-25. (In Japanese).

After four species of aphids, Myzus persicae, Aphis medicaginis, A. gossypii, and Macrosiphoniella sanborini had been feeding on radish seedling affected by Daikon mosaic, the number of individuals which had tapped the sap of radish as well as the amount taken up by them were measured by using P^{32}. Experiments on the mechanism of transmission of Daikon mosaic were also carried out. The amount of sap taken up was greatly increased when the aphid had been starved for 24 h previously. About 95-100% in the case of M. persicae, and 90% of M. sanborini became infected with the mosaic virus after feeding on infected sap. M. persicae and A. medicaginis showed a high level of transmission of Daikon virus; the rate of infection was considerably lower for A. gossypii and M. sanborini.

490* Nishizawa, T., Nishi, Y., Yoshii, H. STUDIES ON THE VARIETAL RESISTANCE OF GARDEN CROPS TO THE VIRUS DISEASE. V. ON THE COURSE OF APHIDS TRANSMISSION OF THE MOSAIC DISEASE OF JAPANESE RADISH DETERMINED BY P^{32} OR S^{35} (1). Bull. Kyushu agric. Exp. Sta. 5 (1958) 35-40. (In Japanese, with English summary).

Four species of aphids (Rhopalosiphum pseudobrassicae, Myzus persicae, Aphis laburni, and Myzocallis arundicolens) were analyzed following 24-h-feeding on P^{32}-labelled radish (Raphanus sativus) seedlings, affected by Daikon mosaic. The first two species, considered main vectors, showed high counts, the last none, while A. laburni occupied an intermedfate position. When M. persicae was fed on infected seedling (root-labelled with P^{32}), then on a healthy seedling for 20 min, and on another for 24 h, radioactivity was found in the plants even when infection could not be proved. When the aphid was allowed to feed on an infected plant for 24 h it was able to transmit the virus to a new host; even when preceded by starvation for 6 h at 20°C it was able to transmit P^{32} to a new host. When the aphid was fed on the leaf of radish seedling which had absorbed S^{35} for 24 h, S^{35} could be recognized in the rostrum, pharynx, salivary gland, and the alimentary canal.

491 Nishizawa, T., Nishi, Y., Kimura, T. STUDIES ON THE MECHANISM OF APHID TRANSMISSION OF MOSAIC DISEASE OF JAPANESE RADISH USING RADIOACTIVE PHOSPHORUS 32. Virus 9, 2 (1959) 130-3. (In Japanese, with English summary).

The studies were carried out at 15-20°C. Aphids (Myzus persicae Sulz.) were allowed to feed for 5 and 10 min on virus-diseased Japanese radish (Raphanus sativus L.) seedling cultured in a solution containing 200 mc P^{32}/ml. They were then transferred successively to 10 healthy radish seedlings and allowed to feed for 5 and 10 min, respectively. Aphids transmitted the virus up to the 6th seedling; all 10 seedlings on which the aphids had been feeding were, however, radioactive as determined by autoradiography. Aphids which had fed for 10 min, 1 min and 30 sec, respectively were transferred successively to 8-15 healthy radish seedlings and allowed to feed for 1 min or 30 sec in each case. With only brief feeding on infected material (1 min or 30 sec) no appreciable differences could be observed between virus and P^{32} transmission.

See also:

28 The feeding of normal and aster yellows-inoculated corn leafhoppers. (Orenski and Maramorosch, 1962)

444 The fate of turnip yellow mosaic virus in the nonvector aphid Hyadaphis brassicae (L.). (Hutchinson and Matthews, 1963)

II CHEMICAL CONTROL MEASURES

II-A General Articles. Surveys. Books. Symposia

492 Andreev, S.V., Martens, B.K., Molchanova, V.A. RADIOACTIVE ISOTOPES IN THE DETERMINATION OF QUALITY OF SPRAYING OF AGRICULTURAL PLANTS BY PESTICIDES. Vestn. sel'skokh. Nauki 8, 4 (1963) 135-8. (In Russian).

Application of radioactive isotopes makes possible the qualitative and quantitative determination of the deposit of pesticides from both ground and aerial spray. Radioisotopes with a short half-life can be used so that the method is not dangerous. Degree of irregularity in the deposit of pesticides in horizontal and vertical directions and correction coefficients can be determined on the basis of which an optimum spray programme and consumption norm of pesticides can be determined. (CA 59: 1963, 8065e)

493 Bridges, R.G. RADIOISOTOPES - A UNIQUE TOOL IN PEST CONTROL. Int. Pest Control 5, 4 (1963) 6-10, 13.

Article deals with the applications of radioisotopes in insecticide research.

494 Casida, J.E. USE OF RADIOISOTOPES IN INSECTICIDE STUDIES. p.427-38 in "Applications of Radioisotopes and Radiation in the Life Sciences 1961". Hearings before the Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy, Congress of the United States. 87th Congress, 1st Session, 27-30 March 1961.

Problems and progress in the use of radioisotopes in insecticide research are reviewed. A list is included of labelled insecticides prepared to date; the chemical structure; label; distribution and metabolism in insects, mammals, and plants; chemical studies; plant residues; and insect resistance. The radioisotopes used in labelling insecticides include tritium, C^{14}, P^{32}, S^{35}, Cl^{36}, As^{74}, As^{76}, Br^{82}, I^{131}, and Pb^{212}. (NSA 15: 1961, 27332.)

495 Casida, J.E. RADIOTRACER STUDIES ON THE MECHANISM OF INSECTICIDAL ACTION. Final Report. TID-19836, Wisconsin, Univ., Madison, 1963, 13p.

Insecticides or other compounds of possible importance in the mechanism of insecticidal action were labelled with radioisotopes and used in studies of the mechanisms of insecticidal action. Metabolic changes in the labelled compounds were followed in biological systems of interest and the metabolites characterized when possible. An attempt was made to relate the results to the mode of insecticidal action or other types of biological activity. Data were obtained on the persistence and toxic effects of the insecticides in plants where applicable. Results are reported from studies on organophosphate insecticides labelled with P^{32}, carbamate insecticides labelled with C^{14}, aromatic acids labelled with C^{14}, sterol metabolism in insects using cholesterol-C^{14} as a tracer, iodine metabolism in insects using I^{131} as a tracer, and rotenone labelled with C^{14}. A list is included of 44 publications resulting from these studies. (NSA 18: 1964, 6595)

496 Keams, C.W. THE MECHANICS OF INSECT CONTROL. Span 6, 2 (1963) 82-7.

Includes physiological and biochemical action of insecticides, sterilization, and use of attractants, as recent developments. (B.Ag. 27: 1963, 102880)

497 Plapp, F.W., Jr., Lindquist, D.A. RADIOISOTOPES IN THE STUDY OF THE FATE OF INSECTICIDES APPLIED TO ANIMALS AND PLANTS. p.171-82 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Review article concerned with the wide range of problems which have been attacked by means of radioisotopes. Labelled insecticides have been essential in obtaining some basic information on plant systems. By utilizing labelled materials it has been shown that cotton plants grown from seed treated with systemic

insecticides absorb < 50% of the applied dose. Other studies have demonstrated that systemic insecticides are not readily translocated from treated leaves to new growth. Areas of future research are outlined.

498 Smith, J.N. DETOXICATION MECHANISMS. Annu. Rev. Ent. 7 (1962) 465-76.

Review article. Radioisotopes were employed in some of the studies mentioned. No particular emphasis is given to them.

499 Smith, G.N. ISOTOPE METHODS. p.325-72 in "Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives. Vol.I. Principles, Methods, and General Applications". Zweig, G., Ed. New York, Academic Press, 1963.

The article confines itself to aspects directly relevant to pesticide residue work. Separate sections deal with laboratory layout (arrangement, construction and furniture, storage of radioisotopes, radioactive waste disposal, decontamination of equipment and personnel), selection of compounds, instrumentation (counting devices: ionization chambers, G.-M. counters, windowless flow counter, gas-phase counters, immersion counters, liquid scintillation counters; ratemeters and scalers; special equipment:automatic sample changers, recorders, column monitors, detectors for radioactivity on paper strips; choice of counting technique), preparation of samples (P^{32}, S^{35}, halogens, C^{14}), counting of samples (background count, coincidence correction, self-absorption corrections, back-scattering, counting efficiency, decay corrections), reporting radioactive data, special techniques, and a glossary. The need is stressed for reporting the following factors for evaluating a pesticide experiment: 1. Compound (isotope and position of labelling, specific activity and how determined, radiochemical purity of compound and how determined, physical and chemical properties of compound). 2. Treatment of plant or animal (dosage and how applied, treatment of plant or animal during observation period, when treated and when sacrificed, how sample was stored prior to analysis). 3. Counting (technique used in preparing samples for counting and equipment used for counting, background count and standard deviation, sample count and standard deviation, corrections applied in calculating net count rate, if reported in ppm or μg calculations of count conversion to ppm or μg). 4. Isolation procedure.

500 Sun, Y.-P., Johnson, E.R. A NEW BIOASSAY TECHNIQUE, WITH SPECIAL REFERENCE TO THE SPECIFIC BIOASSAY OF DDVP INSECTICIDE. J. econ. Ent. 56, 5 (1963) 635-41.

Based on a combination of several physical properties of insecticides, a new bioassay technique has been developed. This method consists of depositing insecticide and kerosene on a filter paper in a petri dish and confining insects* in another dish separated from the first by another filter paper. At 2-h exposure and with 10 mg of kerosene in each deposit, interferences of 25 organophosphorus, 16 chlorinated, and 3 carbamate insecticides are less than 1% of apparent DDVP. Radioassay of C^{14} DDVP and gas-liquid chromatographic analysis of aldrin support the hypothesis for the mechanism of this technique. (Auth.)

* (In the present case, Drosophila melanogaster)

501 Various. Abstracts of Papers Presented at the 7th Symposium of the Japanese Society of Entomology and Zoology, College of Agriculture, University of Tokyo, 8 April 1963. Jap. J. appl. Ent. Zool. 7, 3 (1963) 234-81. (In Japanese).

Studies are reported, many of them using radioisotopes (mostly P^{32}, C^{14}; some Br^{82}), on a variety of topics such as insect resistance to insecticides; metabolism and toxicity of insecticides in insects; physiological aspects of lipid metabolism in insects; insect dispersal; the mechanism of hatching; etc.

502 Winteringham, F.P.W. ACTION AND INACTION OF INSECTICIDES. J. roy. Soc. Arts 110 (1962) 719-37.

Review article. The author deals with such aspects as the need for more selective insecticides; the problem of insecticide resistance; the incidence of resistant insects in the field; behaviouristic resistance; physiological resistance; detoxication as a mechanism of insect resistance; mechanisms of resistance not involving enzymic detoxication; the phenomenon of cross-resistance; and the action of insecticides. Current trends and prospects are discussed, also such novel methods of chemical insect control as are represented by chemosterilants. The review is documented by 102 references which also include studies in which radioisotopes have been used.

503 Zweig, G. THE PESTICIDE RESIDUE LABORATORY. p.123-30 in "Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives. Vol.I. Principles, Methods, and General Application". Zweig, G., Ed. New York, Academic Press, 1963.

The organization of such a laboratory in terms of storage, processing and extraction, clean-up procedures, final analysis, library, and personnel is discussed. Isotope methods are mentioned briefly on p.129. If the pesticide has a reactive functional group, like carboxyl, the crude extract may be reacted with C^{14}-diazomethane, and the resultant C^{14}-methyl ester of the pesticide separated physically (e.g. by paper or gas chromatography) and counted. The counting equipment here includes a counter, scaler, and a paperstrip scanner.

See also:

150 Böcek fizyolojisi ve bilhassa toksikolojisi ile ilgili arastirmalarda radyoizotoplarin kullanilmasi. (Radioisotopes in research on insect physiology and toxicology). (Kansu, 1961)
550 Organophosphorus poisons. Anticholinesterases and related compounds. (Heath, 1961)

II-B Fumigants

II-B-a GENERAL

504 Page, A.B.P., Lubatti, O.F. FUMIGATION OF INSECTS. Annu. Rev. Ent. 8 (1963) 239-64.

Review article, with incidental mention of work in which radioisotopes were utilized.

See also:

1548 Direct elemental analysis of citrus crops by instrumental neutron activation. A rapid method for total bromide, chloride, manganese, sodium and potassium residues. (Castro and Schmitt, 1962)

II-B-b CYANIDES

505 Bond, E.J. THE ACTION OF FUMIGANTS ON INSECTS. I. THE UPTAKE OF HYDROGEN CYANIDE BY Sitophilus granarius DURING FUMIGATION. Canad. J. Zool. 39 (1961) 427-36.

An apparatus and a procedure for experimental fumigation of the insects are described, with graphs of uptake and release of HCN gas. The rate of uptake increased linearly during exposure even after lethal amounts of HCN had been taken up. The sorbed HCN was partly recoverable and partly not recoverable from the bodies of the insects. After exposure to non-fatal concentrations the insects contained some loosely-bound HCN, of which a part disappeared after a few hours. However, some HCN was recoverable even after 288 hours, during which time the compound had no obvious effects on the surviving insects. Neither rhodanese nor thiocyanate resulting from its detoxifying action could be demonstrated. On using HCN labelled with C^{14}, the resulting metabolic products were not 2-imino-4-thiazolidinecarboxylic acid, demonstrating that cystine did not detoxify the HCN. This was also the case with the desert locust Schistocerca gregaria. Detoxication mechanisms for HCN thus differ from those in mammals. (CA 55: 1961, 26289c)

506 Bond, E.J. THE ACTION OF FUMIGANTS ON INSECTS. II. THE EFFECT OF HYDROGEN CYANIDE ON THE ACTIVITY AND RESPIRATION OF CERTAIN INSECTS. Canad. J. Zool. 39 (1961) 437-44.

HCN at certain concentrations caused complete inhibition of respiration in Sitophilus granarius but not in other insects (named). S. granarius differed in its reactions to HCN and to anoxia. Those exposed to HCN showed diminished pigmentation and other changes and were more resistant to MeBr. The data indicate that HCN may act on this species by combining with cytochrome oxidase. Combination of carbohydrates with the HCN to form cyanohydrins is the possible protective mechanism. (CA 55: 1961, 26289e)

507 Bond, E.J. THE ACTION OF FUMIGANTS ON INSECTS. III. THE FATE OF HYDROGEN CYANIDE IN Sitophilus granarius (L.). Canad. J. Biochem. Physiol. 39 (1961) 1793-1802.

A study of the fate of hydrogen cyanide in fumigated S. granarius adults, using C^{14} labelled cyanide, showed that this poison became generally distributed and combined with various metabolites. Labelled

carbon was found in three compounds of a trichloroacetic acid extract and in one compound of the hydrolyzed proteins and in the body fats. Only a very small amount of the C was excreted from the insect's body as CO_2, but a considerable amount was found in the excrement: 9 radioactive compounds were isolated from the water-soluble fraction of the excrement. One of these, a polypeptide, contained nearly half of the total labelled carbon that was excreted and most of the activity was present in the aspartic acid portion of the compound; thus it appears that this insect can not only excrete amino acids but also it can synthesize and use them for the elimination of cyanide from their bodies. (Auth.)

508 Tschiersch, B. THE METABOLISM OF HYDROCYANIC ACID. Flora, Jena 153, 1 (1963) 115-21. (In German).

Seedlings, 2-6 d old, of Linum usitatissimum were exposed to 98.6 μc $HC^{14}N$ in glass containers. Radioactivity appeared in the 70% EtOH-soluble fraction and in the hydrolyzate of the insoluble fraction within 10 min. After 24 h, 6.39% of the total activity was found in these fractions. After 10 min exposure, the activity was strong in asparagine and slight in aspartic acid and in 2 unidentified compounds. Only after 6 h did laminarin show activity, as did many amino acids, organic acids, and sugar. Parallel experiments were run with $C^{14}O_2$. Possible pathways of HCN assimilation are discussed. (CA 59: 1963, 9090h).

509 Андреева, О.И., Костикова, Г.И. ИЗУЧЕНИЕ РЕАКЦИЙ ИЗОТОПНОГО ОБМЕНА УГЛЕРОДА МЕЖДУ ЦИАНИСТЫМ КАЛИЕМ И КАРБОНАТАМИ И ПРИМЕНЕНИЕ ИХ ДЛЯ ПОЛУЧЕНИЯ ЦИАНИСТОГО КАЛИЯ МЕЧЕННОГО ИЗОТОПОМ C^{14}. Стр.111-22 в сб. "Радиоизотопы в физических науках и промышленности. Труды Конференции, Копенгаген, 6-17 сентября, 1960", т.3. Вена, Международное агентство по атомной энергии. 1962.

Andreeva, O.I., Kostikova, G.I. STUDY OF CARBON-ISOTOPE EXCHANGE REACTIONS BETWEEN POTASSIUM CYANIDE AND SOME CARBONATES, AND THEIR USE FOR OBTAINING C^{14}-LABELLED POTASSIUM CYANIDE. p.111-22 in "Proceedings of a Conference on Radioisotopes in the Physical Sciences and Industry, held in Copenhagen, 6-17 September, 1960". Vienna, International Atomic Energy Agency. 1962.

The isotope exchange of KCN with compounds differing greatly from it in composition and structure (e.g. carbonates of alkaline and alkali-earth metals) has been studied. The carbon-isotope exchange reaction in the $KC^{12}N$-$BaC^{14}O_3$ system was investigated at 600-800°C. At high temperatures complete exchange between these compounds can be secured. With carbonates of alkali metals the exchange reaction occurs on melting and is completed at lower temperatures. Labelled potassium cyanide was obtained by (1) the isotope exchange reaction $KC^{12}N$-$BaC^{14}O_3$ (produced in 2 h at 800°C), and (2) by separation of the mixture KCN+$BaCO_3$ through extracting the KCN with liquid ammonia in a circulating extractor. By exchanging the equimolecular quantities KCN and $BaCO_3$, potassium cyanide is obtained with a chemical yield of > 90% and a basic-substance content of 96-97%. By using $BaCO_3$ with a high specific activity (60-70 mc/g), a KCN specific activity of > 80 mc/g may be obtained. The barium carbonate depleted of C^{14} regenerates after the NH_4OH extraction without appreciable loss.

11-B-c METHYL BROMIDE AND OTHERS

510 Japan. Food Research Inst., Tokyo. STUDIES ON THE MECHANISM OF FUMIGANTS. Nucl. Sci. Abstr., Japan 1, 3/4 (1962) 74. (In English).

C^{14}-labelled methyl bromide was synthesized to determine the residue and distribution in brown rice, soybean and packaging materials after fumigation. The residual radioactivity in brown rice and soybean remained nearly constant after 1 month following fumigation. High radioactivity was found in bran and endosperm of brown rice, but less in white rice. Methylation may thus occur in brown rice and soybean. Rice bran and endosperm are rich in protein, oil and vitamin B-complex. High residual radioactivity appears to be present in the protein fraction, less in the starch and only negligible amounts in the oil fraction of brown rice. Residual radioactivity in rice bran was distributed as follows: vitamin B complex 9%, protein fraction 42%, and residue 49%. The possible reaction of amino acids with methyl bromide to form their derivatives is discussed in the light of results from paper partition, chromatography, paper electrophoresis and absorption spectres. Methyl bromide was sometimes retained in packaging materials, in the order: polyethylene film, straw of rice, cellophane, craft paper, hemp, and mylar.

511 Meikle, R.W., Stewart, D. THE RESIDUE POTENTIAL OF SULFURYL FLUORIDE, METHYL BROMIDE, AND METHANE-SULFONYL FLUORIDE IN STRUCTURAL FUMIGATIONS. J. agric. Food Chem. 10, 5 (1962) 393-7.

The syntheses of sulfuryl-S^{35} chloride, sulfuryl-S^{35} fluoride, methane-C^{14}-sulfonyl chloride, methane-C^{14}-sulfonyl fluoride and methyl-C^{14} bromide are described. Fumigation experiments were carried out on a number of different samples. Once a constant count rate was obtained after exposure under specified conditions the sample was combusted and the C^{14}-barium carbonate and S^{35}-barium sulfate counted. A comparison of the carbonate and sulfate count rates allowed estimation of final (ppm) residues and interpretation of previous count rates on the fumigated samples in these terms. The results and implications are discussed in some detail.

See also:

732 Bromine residue in wheat and milled wheat fractions fumigated with methyl bromide. (Lindgren et al., 1962)

II-B-d METHYL ISOTHIOCYANATE

512 Kötter, K., Willenbrink, J., Junkmann, K. THE DEGRADATION OF METHYL ISOTHIOCYANATE-S^{35} IN VARIOUS SOILS. Z. Pf.Krankh. 68 (1961) 407-11.

To 50 ml of a soil preparation, corresponding to 100 ml/l soil was added 0.1 ml 5% solution Me isothiocyanate-S^{35}, shaken 1 h in a sealed test tube and then stored at 18°C. The tubes were opened under MeOH saturated with NH_3, emptied, and rinsed with MeOH. The solution was shaken 3 min, then filtered, and the filter was washed with NH_3-MeOH. The filtrates contained all the Me isothiocyanate of the soil samples and only approximately 2% of the SO_4. The soil residue was treated with pH 1 HCl in water, filtered, and washed with the same. The SO_4 of the solution was precipitated as $BaSO_4$. The solution containing only nonsulfate S compounds was evaporated to dryness, taken up with 10 ml, HNO_3, cleared by additions of H_2O_2, and its SO_4 precipitated as $BaSO_4$. The insoluble soil residue was heated with Na_2O_2 and ethylene glycol. Aliquots of the $BaSO_4$ precipitates and the MeOH solutions were counted in a scintillation counter. Counts were adjusted so that the sums of the percentages were 100%. The crude sums varied over the range 85-115%. Decomposition was rapid, as previously reported, in compost and also in loam during 21 d. Steam sterilization of the soils retarded it. Degradation was slight in peat and not measureable in pure sand. (From CA 55: 1961, 23888i)

II-B-e NAPHTHALENE

513 Arias, R.O., Terriere, L.C. THE HYDROXYLATION OF NAPHTHALENE-1-C^{14} BY HOUSEFLY MICROSOMES. J. econ. Ent. 55 (1962) 925-9.

Techniques used in isolating a subcellular fraction of housefly (Musca domestica) tissue capable of converting naphthalene to 1-naphthol and 1,2-dihydro-1,2-dihydroxynaphthalene are described. Incubation conditions studied include pH, temperature, time, substrate level, microsome level, and cofactor requirements. The hydroxylating activity of housefly microsomes appears to vary with the growth and development of the life stages, with older adults exhibiting greatest activity and larvae, the least. The cofactor reduced triphosphopyridine nucleotide seems to be more critical in the microsomal activity of mature adults. (CA 58: 1963, 9450h)

514 Boose, R.B., Terriere, L.C. THE RATE OF METABOLISM OF NAPHTHALENE BY RESISTANT AND SUSCEPTIBLE HOUSE FLIES. (Abstr.26). Bull. ent. Soc. Amer. 8, 3 (1962) 154.

A non-resistant and two chlorinated-hydrocarbon-resistant strains of houseflies were compared with respect to rate of metabolism of injected naphthalene-C^{14}. Comparisons were made by C^{14} measurements after wet oxidation of insects at various intervals after injection. No differences in rate of metabolism or in nature of metabolites have been observed.

515 Schonbrod, R.D., Terriere, L.C. THE METABOLISM OF NAPHTHALENE BY HOUSE FLY MICROSOMES AND ITS INHIBITION BY INSECTICIDE SYNERGISTS. (Abstr.26). Bull. Ent. Soc. Amer. 8, 3 (1962) 154.

Microsomes prepared from housefly tissue by centrifugation convert naphthalene-C^{14} into several hydroxylated products. These primary oxidation products are further metabolized by conjugation with tissue constituents. SKF 525A and pyrethrin synergists inhibit these reactions.

516 Terriere, L.C., Boose, R.B., Roubal, W.T. THE METABOLISM OF NAPHTHALENE AND 1-NAPHTHOL BY HOUSEFLIES AND RATS. Biochem. J. 79 (1961) 620-8.

Musca domestica L. (3-4 d old, of mixed sexes) and rats were fed with [1-C^{14}] naphthalene and 1-[1-C^{14}] naphthol and the products of their metabolism examined. By paper chromatography, these products were identified as glucosiduronides of 1-naphthol, 1:2-dihydro-1:2-dihydroxynaphthalene and 1:2-dihydro-1-hydroxynaphthalene; 1-naphthylsulphate; mercapturic acid conjugates of 1-naphthol and 1:2-dihydro-1:2-dihydroxynaphthalene; free 1-naphthol and 1:2-dihydro-1:2-dihydroxynaphthalene. 2-Hydroxy-1-naphthyl sulphate may also be present. All the metabolites produced by naphthalene- and 1-naphthol-treated flies were found in the urine of rats treated with naphthalene, but only 6 were produced by rats given 1-naphthol. Metabolites not previously detected in the urine of 1-naphthol-treated rats are 1:2-dihydro-2-hydroxy-1-naphthyl glucosiduronic acid and 1-naphthylmercapturic acid. (Based on auth. summary)

See also:

635 The in vitro hydroxylation of naphthalene-1-C^{14} by housefly microsomes. (Arias, 1963)

II-B-f VIKANE

517 Meikle, R.W., Stewart, D., Globus, O.A. DRYWOOD TERMITE METABOLISM OF VIKANE FUMIGANT AS SHOWN BY LABELED POOL TECHNIQUE. J. agric. Food Chem. 11, 3 (1963) 226-30.

The mode of action of Vikane fumigant (sulfuryl fluoride) in destroying the Western drywood termite, Kalotermes minor Hagen, was investigated using the labelled-pool technique. S^{35}-labelled Vikane was used. The termites were labelled by being allowed to feed on paper towelling impregnated with sodium acetate-1-C^{14} or with P^{32}-labelled phosphate. The results strongly indicate that inorganic fluoride is the primary poison, from a consideration of the disturbances in intermediary metabolism. These disturbances were deduced from variations in the paper chromatographic spectra of the labelled metabolites isolated from fumigated and control termites.

II-B-g SULFUR DIOXIDE

518 Materna, J., Kohout, R. DIE ABSORPTION DES SCHWEFELDIOXIDS DURCH DIE FICHTE. (The absorption of sulphur dioxide by fir trees). Naturwissenschaften 50, 11 (1963) 407. (In German).

In the experiments described, 15-20-year old, healthy isolated firs were used. A well-developed branch, about 10 years old, was surrounded with a polyethylene sleeve into which a phial of $S^{35}O_2$ was broken, giving an initial concentration of 8-10 mg of SO_2/m^3 of air. After at most 90 min, the sleeve was removed and the needles tested. It was found that the needles of the treated branch had absorbed nearly the entire SO_2, and that it is translocated to a lesser extent to unfumigated needles in other parts of the tree. Its transfer to needles of new shoots is very noticeable. SO_2 is also absorbed during the night.

519 Weigl, J., Ziegler, H. DIE RÄUMLICHE VERTEILUNG VON ^{35}S UND DIE ART DER MARKIERTEN VERBINDUNGEN IN SPINATBLÄTTERN NACH BEGASUNG MIT $^{35}SO_2$. (The spatial distribution of S^{35} and the identity of the tagged compounds in leaves of spinach after treatment with $S^{35}O_2$ gas). Planta 58 (1962) 435-7. (In German).

An apparatus is described in which $S^{35}O_2$ is generated from $H_2S^{35}O_4$ in a closed system. Formation of S^{35} compounds, treatment of plants with $S^{35}O_2$, and preparation for gas chromatography are done in the closed system, which is provided with means for flushing out radioactive gas. An electrophoretic method is described for the separation of sulfite, sulfate, S-contained amino acids, and compounds in which the S was protected from oxidation by combining with ethylmaleinimide. A gas chromatographic technique is described, sensitive to 20 ppm SO_2. Pieces were cut from the leaves of spinach plants after 7 h exposure to 50 ppm $S^{35}O_2$, sectioned and fixed on microscope slides. Microautoradiography showed that S^{35} was 2-5 times as abundant in the guard cells of the stomata as in other cells of the epidermis. Some was found

in the vascular tissue. The S^{35} was quickly incorporated into cysteine and glutathione as well as unidentified soluble and insoluble compounds. A considerable proportion had been oxidized to sulfate. (CA 57: 1962, 12909e).

II-B-h CARBON DISULFIDE

520* Sokolov, V.A. AN INVESTIGATION OF ISOTOPE EXCHANGE IN THE SYSTEM CS_2-S^{35} FOR THE PREPARATION OF LABELED CARBON DISULFIDE. p.367-72 in "Izotopy i izlucheniya v khimii. Trudvtoroĭ Vsesoyuznoĭ nauchno-tekhnicheskoĭ konferentsii po primeneniyu radioaktivnykh i stabil'nykh izotopov i izlucheniĭ v narodnom khozyaĭstve i nauke, Moskva, 1957. Moskva, Izv. Akad. Nauk SSSR. 1958. (In Russian). English Translation: AEC-tr-4497.

See also:

1551 Apparatus for treating insects with radioactive fumigants. (Bond and Call, 1961)

II-C Halogenated and Other Hydrocarbons

II-C-a GENERAL

521 Hoskins, W.M. PHYSIOLOGY AND BIOCHEMISTRY OF RESISTANCE TO CHLORINATED HYDROCARBONS. p.221-6 in "XI. Internationaler Kongress für Entomologie, Wien, 17 - 25 August 1960. Verhandlungen, Band III (Symposien)". Wien, Organisationskomitee des XI. Internationalen Kongresses für Entomologie, Wien 1960. 1962. (In English).

Review article, with (incidental) mention of results obtained with radioisotopes.

II-C-b ALDRIN AND DIELDRIN

522 Gerolt, P. INFLUENCE OF RELATIVE HUMIDITY ON THE UPTAKE OF INSECTICIDES FROM RESIDUAL FILMS. Nature, Lond. 197 (1963) 721.

That the uptake of C^{14}-labelled dieldrin from glass surfaces by resistant strains of Musca domestica and Anopheles gambiae and by a normal susceptible strain of Aedes aegypti was higher at 90% relative humidity than at 10%, confirmed that the toxicant was more available under humid than under dry conditions. The same effect was noted with dieldrin-impregnated filter paper and γ-BHC and DDT on dried soils, thus suggesting the phenomenon is general. Insects that walked over the treated surfaces actively showed less humidity effect than did those remaining stationary, or nearly so, during the experiment. (CA 58: 1963, 10676a)

523 Heath, D.F. Cl^{36} DIELDRIN IN MICE. p.83-91 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

The distribution of Cl^{36}-dieldrin injected intravenously into mice (LAC grey strain) was studied. Extraction of Cl^{36}-dieldrin from tissues proved difficult, and experimental techniques are described in detail. Shortly after injection, high concentrations were found in the liver and brain, but the compound rapidly dispersed and, 24 h after injection, was mainly in the fatty tissues. Very little was excreted, some was probably metabolized. An attempt is made to relate these findings to the toxic effects. (Auth.)

524 Korte, F., Rechmeier, G. INSEKTIZIDE IM STOFFWECHSEL. I. MIKROSYNTHESE VON ALDRIN-[^{14}C] UND DIELDRIN-[^{14}C]. (Insecticides in metabolism. I. Microsynthesis of C^{14}-labelled aldrin and dieldrin). Liebigs Ann. 656 (1962) 131-5. (In German).

A method for microsynthesizing aldrin and dieldrin is described. When starting with $BaC^{14}O_3$ (specific activity 20.2 mc/mM) the total yields of labelled aldrin and dieldrin are 36% and 35%, respectively. The specific activity of the end products corresponds to the activity of the $BaC^{14}O_3$ used.

525 Korte, F., Ludwig, G., Vogel, J. INSEKTIZIDE IM STOFFWECHSEL. II. UMWANDLUNG VON ALDRIN-[^{14}C] UND DIELDRIN-[^{14}C] DURCH MIKROORGANISMEN, LEBERHOMOGENATE UND MOSKITO-LARVEN. (Insecticides in metabolism. II. Metabolism of C^{14}-labelled aldrin and C^{14}-labelled dieldrin in microorganisms, liver homogenates and mosquito larvae). Liebigs Ann. 656 (1962) 135-40. (In German).

C^{14}-labelled aldrin was absorbed by mosquito larvae (Aëdes aegypti) and microorganisms and converted not only into dieldrin but to a large extent into at least 4 other components. C^{14}-labelled dieldrin gave the same as yet unidentified conversion products. The conversions of C^{14}-labelled aldrin effected by various microorganisms are listed. C^{14}-labelled dieldrin was not effected by them. Conversions of C^{14}-labelled aldrin and dieldrin as effected by mosquito larvae are also given. A single lethal dose (~0.5 - 0.9 ppm) killed all larvae within 12-15 h, the greater part of the activity remaining in the larvae (representing 95% aldrin, 2% dieldrin, 3% metabolites), and only ~10% (representing 50% aldrin, 50% metabolites) in the aqueous phase. After several sub-lethal doses every 6-8 h, only ~$\frac{1}{2}$ the activity is found in the larvae and large amounts of breakdown products in the aqueous phase. If a single very low dose of aldrin or dieldrin (~$\frac{1}{2}$ LD_{50}) is given, only 20-25% of unchanged aldrin or dieldrin remain after 24 h and only 3-5% after 48 h. The remainder (~80%) is found as metabolites in the aqueous phase. C^{14}-labelled aldrin in concentrations of 0.4 ppm in homogenates of fresh beef liver incubated 4 h at 37°C gave 50% C^{14}-labelled dieldrin; no other conversions products were detected. C^{14}-labelled dieldrin in concentrations of 0.25 ppm treated similarly remained unconverted. Recent studies in rats have shown that mammals can convert aldrin. After an intravenous dose of C^{14}-labelled aldrin > 60% of the radioactivity was found in the faeces of the rat.

526 Korte, F., Kochen, W., Ludwig, G., Rechmeier, G., Schreiber, H.J., Stiasni, M., Vogel, J. SYNTHESEN UND UNTERSUCHUNGEN VON EINIGEN C^{14}-MARKIERTEN INSEKTIZIDEN AUS DER REIHE DER HALOGENIERTEN KOHLENWASSERSTOFFE UND DES IRIDOMYRMECINS. (Syntheses and studies on some C^{14}-labelled insecticides belonging to the halogenated hydrocarbons and on labelled Iridomyrmecin). Vortrag, Chemiedozenten-Tagung, Bonn, April 1962. (In German). An abstract was published in Angew. Chem. 74 (1962) 503.

Microsyntheses of C^{14}-labelled aldrin, dieldrin, Telodrin, heptachlor, chlordane, and Iridomyrmecin have been elaborated. Starting with labelled $BaCO_3$ (specific activity ~20 mc/mM) compounds of the same specific activity are obtained, labelled in the chlorinated ring, via hexachloro-cyclopentadiene-C^{14}. The total yields relative to $BaCO_3$ were: aldrin 36%; dieldrin 35%; Telodrin 25%; heptachlor 32%; chlordane 22%, Telodrin-1,3-C^{14} (labelled in the tetrahydrofurane ring) was synthesized with a 21% total yield, Iridomyrmecin-3-C^{14} with a 16% yield. The metabolism of the insecticides was followed in micro-organisms, mosquito (Aëdes aegypti) larvae, and rats.

527 Mörsdorf, K., Ludwig, G., Vogel, J., Korte, F. DIE AUSSCHEIDUNG VON ALDRIN-C^{14} UND DIELDRIN-C^{14} SOWIE IHRER METABOLITEN DURCH DIE GALLE. (The excretion of C^{14}-labelled aldrin and dieldrin as well as their metabolites via the bile). Med. Exp. 8 (1963) 90-4. (In German, with French and English summaries).

The experiments were carried out on male white rats to which the insecticides were administered intravenously (C^{14}-labelled aldrin of a specific activity of 20.7 mc/mM: 46 γ; and C^{14}-labelled dieldrin of specific activity 20.7 mc/mM: 84 γ. Aldrin and dieldrin together with their metabolites were excreted preferentially in the bile. Aldrin was found to be converted into dieldrin and another hydrophilic metabolite in the organism. Similarly, dieldrin gave rise to a hydrophilic metabolite which, on paper chromatography, was found to be identical with the hydrophilic product obtained from aldrin.

528 Potter, C.R. PICK-UP AND PENETRATION OF DIELDRIN FROM RESIDUAL FILMS. p.142-4 in "Report of the Rothamsted Experimental Station for 1960". Harpenden, Rothamsted Experimental Station, 1961.

In order to study pick-up, distribution, and penetration of the insecticide and their bearing on its toxicity to the insect, films of Cl^{36}-labelled dieldrin were used. Adult Tenebrio molitor L. were placed on them, and insects and containers were subsequently analysed for radioactivity; 30-min and 2-h exposures to 500 γ/32.2 cm^2 at 25°C were used. At the time the insects were removed from the film, 1/6 of the dose picked up could be shown to have penetrated, 1/3 after 1$\frac{1}{2}$ h and 2/3 after 2$\frac{1}{2}$ h, ~1/10 of the total dose being lost to the container. Cl^{36}-dieldrin was not active enough to enable individual insects to be examined, and was subsequently replaced by C^{36}-dieldrin for further studies.

529 Rechmeier, G. MIKROSYNTHESEN VON C^{14}-MARKIERTEN INSEKTIZIDEN UND BIOCHEMISCHE UNTERSUCHUNGEN. (Microsyntheses of C^{14}-labelled insecticides and some biochemical studies). Thesis. Bonn. Universität. Organisch-Chemisches Institut. 1962. 66p. (In German).

C^{14}-labelled hexachlorocyclopentadiene (I) was obtained from $BaC^{14}O_3$ (specific activity 20.2 mc/mM) with a 37% yield (specific activity after dilution: 8.64 mc/mM). Four labelled insecticides were synthesized subsequently: aldrin-C^{14} (yield 82% relative to I), dieldrin-C^{14} (yield 79%); chlordane-C^{14} (92% yield) (II), heptachlor-C^{14} (yield 78% relative to II), α-chlordane-C^{14} (yield 21.4% relative to II). Biochemical studies were carried out with α-chlordane-C^{14} and heptachlor-C^{14} on Aëdes aegypti, the first giving a metabolite C, the second metabolites A (probably heptachlorepoxide) and B. In experiments on white rats, 55% of the insecticides could be isolated in the organs and excrements within 48 h of intravenous or intraperitoneal injection. The insecticides were not stored in the organs, most of the activity being eliminated in the faeces. The main turnover probably takes place in the liver. Results from in vitro experiments are very different from those obtained under physiological conditions. Human stomach secretions and rat bile did not affect the insecticides in vitro, at body temperature. Various fungi appear to be completely insensitive to the insecticides. The R_f values for the metabolites A, B, and C in the solutions employed agree for rats, fungi, mosquito larvae and liver homogenates.

530 Thomas, D.J., Kilner, A.E. THE SYNTHESIS OF THE INSECTICIDES ALDRIN AND DIELDRIN LABELLED WITH CARBON-14 AT HIGH SPECIFIC ACTIVITY. p.83-90 in "Proceedings of a Conference on Radioisotopes in the Physical Sciences and Industry, held in Copenhagen, 6-17 September 1960, Vol.III". Vienna, International Atomic Energy Agency. 1962.

Acetylene-1,2-C^{14} is converted successively to tetrachloroethane and trichloroethylene, and this is condensed with CCl_4 by the Prins reaction in the presence of aluminium chloride to octachlorocyclopentene. Dechlorination gives hexachlorocyclopentadiene which undergoes a Diels-Alder addition to bicyclo(2,2,1) hepta-2,5-diene to give aldrin-C^{14} in 12% yield from barium carbonate. Oxidation of aldrin gives the 6,7 epoxide, dieldrin, in 87% yield. The paper includes an account of the separation of octachlorocyclopentene from the crude product of the Prins reaction by gas-liquid chromatography and of the separation of aldrin and dieldrin on a small preparative scale by reversed-phase paper chromatography. (From auth.)

II-C-c CYCLODIENE

531 Brooks, G.T., Harrison, A. RELATIONS BETWEEN STRUCTURE, METABOLISM AND TOXICITY OF THE 'CYCLODIENE' INSECTICIDES. Nature 198, 4886 (1963) 1169-71.

A detailed examination of a number of derivatives of 1,2,3,4,7,7-hexachlorobicyclo[2.2.1]hept-2-ene and related compounds was undertaken to elucidate the marked differences in toxicity to adults of Musca domestica L. that exist between closely related compounds of this type and to provide a rational basis for the development of new ones. It would appear that detoxification processes are at least partly responsible for the differences in toxicity to M. domestica between several closely related substances incorporating the hexachlorobicycloheptane nucleus, though other factors may be involved. The greater toxicity of dieldrin and endrin as compared with their precursors (aldrin and isodrin) may be partly due to conversion of a carrier group (the bicycloheptane) of low efficiency to one that is more effective (the epoxybicycloheptane nucleus). The dihydro derivatives of aldrin and isodrin were stabilized by sesamex, and investigations with the compounds labelled with C^{14} confirmed the existence of detoxification mechanism inhibited by sesamex. The oxabicycloheptane system appears to be potentially as effective as the epoxybicycloheptane nucleus as a carrier group. Although an increase in polarity equivalent to that produced by epoxidation increased the toxicity of a molecule of the type of the dihydro derivative of isodrin, the increase in toxicity was not of the expected order. However, the toxicity of this compound appears to be potentially higher than was observed as it is synergized by sesamex, and is metabolized by M. domestica.

II-C-d BHC

532 Atalla, L.T., Lima, F.W. DETERMINATION OF THE γ-ISOMER OF HEXACHLOROCYCLOHEXANE BY ISOTOPE DILUTION. Inst. Energia At., Brazil 59 (1963) 14p. (In English).

The isotope-dilution method, associated with chromatographic separation, was applied to analysis of the γ-isomer of hexachlorocyclohexane. The labelled isomer is prepared by treating benzene with

gaseous Cl labelled with Cl^{36}. Precision of the method is good, having a standard deviation of < 0.1% for samples with ~10% γ-isomer. (CA 60: 1964, 11311b)

533* Elias, H., Lieser, K.H., Kohlschütter, H.W. RADIOCHEMICAL INVESTIGATION OF THE ISOMERIZATION OF 1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE. Chem. Ber. 93 (1960) 2128-37.

The isomerization of γ-(I) and α-1,2,3,4,5,6-hexachlorocyclohexane (II) in the homogeneous system hexachlorocyclohexane-$AlCl_3$-$(CHCl_2)_2$ was studied quantitatively at 100-30° as a function of time with I-C^{14} and II-C^{14}. I-C^{14} (0.14 mg) and 2.6 ± 0.2 mg $AlCl_3$/cm^3 $(CHCl_2)_2$ was heated at various temperatures for certain periods of time, the cooled mixture shaken twice with 10-cm^3 portions 2 N HNO_3 and evaporated, and the residue analyzed by radio-paper chromatogram; the reaction time in h, and the % α-, β-, γ-, and δ-hexachlorocyclohexane in the mixture were given for the runs at the following temperatures: 99.4 ± 0.1°, 4,-, 7.9, 61.9, 30.2; 9, 8.5,-, 40.6, 50.9; 18, 9.4, 5.4, 29.9, 55.3; 50, 25.6, 4.1, 15.6, 54.7; 114.4 ± 0.1°, 4, 15.9, 2.6, 37.4, 44.1; 7.5, 10.7, 5.9, 22.5, 60.9; 12, 27.4,-, 12.1, 60.5; 20, 9.9, 5.5, 12.5, 72.1; 128.5 ± 0.1°, 1, 10.5,-, 44.2, 45.3; 2, 18.3,-, 28.7, 53.0; 5, 26.4, 3.9, 11.0, 58.7; 10, 34.1, 3.2, 8.8, 53.9. A series of similar runs was performed with 0.14 mg II-C^{14} and 2.6 ± 0.1 mg $AlCl_3$/$cm^3$$(CHCl_2)_2$ at the following temperatures (reaction time in h, and % α-, β-, and δ-hexachlorocyclohexane in the reaction mixture given): 99.4 ± 0.1°, 24, 93.2, 6.8,-; 64, 95.3, 3.3, 1.4; 90, 97.1, 2.0, 0.9; 114.4 ± 0.1°, 3, 95.7, 4.3,-; 15.5, 88.4, 8.3, 3.2; 28, 94.0, 4.2, 1.9; 40, 94.6, 3.2, 2.1; 128.5 ± 0.1°, 2, 90.2, 7.9, 1.9; 5, 92.6, 5.6, 1.8; 12.5, 91.5, 4.8, 3.6; 21, 85.6, 7.9, 6.5. The evaluation of these results showed that the isomerization proceeded by equilibrium, reactions according to the scheme: γ-⇄δ-⇄α-isomer. In the temperature region 100-30°, this equilibrium was shifted in favor of the α-isomer. Assuming bimolecular reactions of 2nd order, the rate constants and activation energies of the partial steps of the isomerization were calculated. (CA 55: 1961, 2514f)

534 Fukami, J., Nakatsugawa, T., Ishii, S. PENETRATION OF BHC ISOMERS THROUGH CUTICLE OF THE AMERICAN COCKROACHES. Jap. J. appl. Ent. Zool. 5 (1961) 281-2.

The penetration of α-, β- and γ-isomers of BHC through the insect cuticle has been studied in order to find why only the γ-isomer has a high insecticidal potency. BHC-1-C^{14} isomers were applied topically to Periplaneta americana, and the rate of penetration measured 1.5, 6 and 24 h after treatment. The γ-isomer penetrates more easily than the other isomers, (α-penetrating more quickly than β-BHC). The rates of penetration alone cannot, however, account for the differential toxic potency observed.

535* Ishii, S., Tamaki, Y., Hirano, C. SYNTHESIS OF BHC-1-C^{14} AND SEPARATION OF ITS ISOMERS. MODE OF ACTION OF BHC. I. Botyu-Kagaku 24, 4 (1959) 181-4. (In Japanese, with English summary).

Radioactive BHC was synthesized from C^{14}-labelled benzene: 0.4 mc of benzene-1-C^{14} (0.1 mc/1.32 mg) was diluted to 270 mg with unlabelled carrier benzene and made to react with Cl_2 absorbed in CCl_4 for 29 h under fluotescent light, as described. Crude BHC-1-C^{14} (950 mg) was obtained. Partition chromatography using silica gel and n-hexane saturated with nitromethane was employed for isomer separation. After recrystallization, α-BHC-1-C^{14} 470 mg, β-BHC-1-C^{14} 50 mg, γ-BHC-1-C^{14} 80 mg and δ-BHC-1-C^{14} 50mg were obtained. Radioactive α, β, γ-BHC isomers were confirmed to be chemically pure from autoradiograms of Mitchell's paper chromatographic technique. The wet combustion method using Van Slyke-Folch mixture could not be used for determining γ-BHC-1-C^{14} radioactivity because of sublimation. The specific activity of γ-BHC-1-C^{14} was calculated as 0.389 μc/mg from that of benzene-1-C^{14}. The measured value was in relatively close agreement. (From summary)

536* Ishii, S., Sekiguchi, K., Enjoji, S. SYSTEMIC NATURE OF γ-BHC IN PLANTS. MODE OF ACTION OF BHC. II. Botyu-Kagaku 24, 4 (1959) 184-88. (In Japanese, with English summary).

Radioactive γ-BHC emulsion, consisting of γ-BHC-1-C^{14} (0.398 μc/mg), xylene, triton X-100, and water, was prepared to study systemic action in plants. Experiments were carried out in which the emulsion was sprayed, dropped or used for immersing roots or leaves of the rice plant. From the results obtained it appeared that γ-BHC does not easily penetrate the plant cuticle nor translocate within the plant tissues, at any rate with the specific activity used. The results thus do not agree with studies carried out elsewhere where systemic action of γ-BHC was demonstrated by bioassay.

537* Ishii, S., Matsuda, A. EFFECT OF CHLORINATED TERPHENYL ON EVAPORATION OF γ-BHC. MODE OF ACTION OF BHC. III. Botyu-Kagaku 24, 4 (1959) 188-91. (In Japanese, with English summary).

Chlorinated terphenyls are known to inhibit evaporation of BHC from a surface. Chlorinated terphenyl (Aroclor 5460) was added to γ-BHC-1-C^{14} emulsion to test for changes in residual action of γ-BHC. Radioactive γ-BHC emulsion with or without chlorinated terphenyl was dropped on a glass plate and a rice plant leaf. Subsequent radioactivity was measured daily, and the results tabulated. No detectable residual activity remained on the leaf. Addition of chlorinated terphenyl to BHC emulsion is considered of practical value only for the control of domestic insects and insects in animal sheds.

538 Koransky, W., Portig, J. DER STOFFWECHSEL DER HEXACHLORCYCLOHEXAN-ISOMEREN UND SEINE BEEINFLUSSUNG DURCH MIKROSOMENAKTIVIERENDE PHARMAKA. (The metabolism of hechlorocyclohexane isomers and the effect of microsome-activating drugs). Arch. exp. Path. Pharmak. 243, 4 (1962) 294-5. (In German).

Following the administration of Cl^{36}-labelled BHC, the metabolites contained in the urine and stool of the animals were isolated and partially identified. α-isomer administration produced 4 fractions in the stool, one of which proved to be the unchanged isomer. Organically bound chlorine occurred mostly as 2,4,6-trichlorophenol. The oxidizing microsome enzymes of the liver probably played a part in this transformation. A single pre-treatment with α-BHC causes a marked reduction for about 30 d in the effect of Evipan and Eunarcon. It is therefore possible that the anticonvulsive effect of BHC with some poisons is partially due to accelerated detoxication reactions.

539 Kulikova, M.N., Strongin, G.M., Prokhorova, M.I. DETERMINATION OF δ-HEXACHLOROCYCLOHEXANE BY THE METHOD OF ISOTOPE DILUTION. Trud. Khim. Tekhnol. 1 (1963) 56-60. (In Russian).

A mixture of hexachlorocyclohexane isomers was extracted with enough isooctane to dissolve all δ-isomer (solubility at 20°, 1.6 g/100 g isooctane), which was then separated in 80-94% yield by partition chromatography on SiO_2 gel moistened with $MeNO_2$. In an accelerated procedure, 5 g SiO_2 gel, 2.8 ml $MeNO_2$, and 12 ml isooctane were charged into a column 300-350 mm long and 14 mm in diameter. The isooctane extract containing the δ-isomer was added, and elution with isooctane was carried out. The δ-isomer (15-20 mg) was eluted after the α- and γ-isomers. It was recrystallized from CCl_4-isooctane (yield 50%). The optimum amount of δ-isomer in the sample was 90-160 mg. As a tracer δ-isomer with an activity of 1000 impulses/min/mg was added at a ratio of 1:3 with reference to inactive δ-isomer. On artificial mixtures of α, β, γ, δ-isomers the limit of error was 2.8%. (CA 60: 1964, 16440b)

540 Portig, J., Koransky, W. RESORPTION, VERTEILUNG UND AUSSCHEIDUNG DER HEXACHLORCYCLOHEXAN-ISOMEREN IN BEZIEHUNG ZU IHRER KRAMPFHEMMENDEN WIRKUNG. (Absorption, distribution and excretion of hexachlorocyclohexane isomers in relation to their anticonvulsive effect). In: 3rd Spring meeting of the German Pharmacological Association, 1962. Arch. exp. Path. Pharmak. 243, 4 (1962) 293-4. (In German).

The metabolism and elimination of the α- and γ-isomers of BHC were investigated by means of C^{14}- and Cl^{36}-labelled compounds. Following subcutaneous and intraperitoneal application the material was rapidly distributed throughout the whole organism. High radioactivity was detected (autoradiographically) in the fatty tissue and certain well defined areas of the central nervous system. Consistent quantitative data were obtained when measurements were interpreted in terms of the lipoid content of the organ rather than wet weight. A consistent distribution of the organic lipoids was maintained even with progressive elimination. The radioactive substances contained were isolated and identified. Besides inorganic chlorine and traces of organic chlorinated compounds only unchanged BHC was found. Elimination of radioactivity in the stool and urine commences in the first few hours following application and continues for several weeks. The γ-isomer is eliminated at twice the rate of the α-isomer.

541 Torii, T. GIRDLING EXPERIMENTS ON THE TRANSLOCATION OF TOPICALLY APPLIED RADIOACTIVE γ-BENZENE HEXACHLORIDE-C^{14} IN CERTAIN WOODY PLANT WITH INSECT GALLS. Shinshu Daigaku Nogakuba Kiyo 2, 4 (1961) 355-75.

γ-Benzene hexachloride-C^{14} (I) was applied topically to leaf, flush terminal shoot, stem, and galls located above or below the girdled portion, and its penetration and translocation in the plant tissues was traced by autoradiography. Applied I was absorbed and translocated to several other tissues, acropetally as well as basipetally, and was especially accumulated in flush terminal shoots and galls where growth is active. Phloem is solely responsible for its translocation. The role of I in control of chestnut gall wasp was discussed. (CA 59: 1963, 15874g)

II-C-e CHLORFENSON

542* Tomizwa, C. FATE OF S^{35}-LABELED p-CHLOROPHENYL p-CHLOROBENZENESULFONATE IN SOME ORGANISMS. Botyu-Kagaku 25, 2 (1960) 47-51.

The investigations described showed that chlorfenson labelled with S^{35} was hardly at all decomposed in the eggs or adults of Panonychus (Metatetranychus) citri (McG) (the only stages of that mite tested), but was decomposed progressively in the abdomen, mid-gut and excreta of Periplaneta americana (L.), to which it was not toxic, the production of p-chlorobenzenesulphonic acid increasing in the same order. The product penetrated into Citrus saplings and soybean plants and was translocated. (RAE-A 52: 1964, 48)

II-C-f DDT

543 Acree, F., Jr., Beroza, M., Bowman, M.C. CODISTILLATION OF DDT WITH WATER. J. agric. Food Chem. 11, 4 (1963) 278-80.

The co-distillation rate of DDT with water from a placid surface in μg of DDT/g of water concentration from 1 to at least 100 ppb (100.10^{-9}) at 25°, 30°, and 35°C. At the highest concentrations tested in this study, the co-distillation rate was as much as 6 times greater than that which would be anticipated on the basis of the Rassow-Schultzky equation. This finding is in line with DDT's great affinity for the air-water interface which facilitates the high co-distillation rate. The significance of these results as related to the practical use of DDT is discussed. C^{14}-labelled DDT was used. (Essentially auth.)

544 Menzel, D.B., Miskus, R., Smith, S.M., Hoskins, W.M. THE METABOLISM OF C^{14}-LABELED DDT IN THE LARVAE, PUPAE, AND ADULTS OF Drosophila melanogaster. J. econ. Ent. 54, 1 (1961) 9-12.

A metabolic product of C^{14}-DDT in D. melanogaster Meigen was found to be primarily 2,2,2-trichloro-1,1-bis-(p-chlorophenyl) ethanol, (Kelthane®), confirming the results of Tsukamoto. Kelthane was found in larvae, pupae and adults exposed to larval medium containing C^{14}-DDT and also in adults exposed by topical application to C^{14}-DDT. Of the two strains of Drosophila examined by adult topical exposure, one (Oregon Rc) showed the active formation of Kelthane, while the other (Oregon R) did not. A new, unknown metabolite of the same chromatographic mobility as p,p'-dichlorobenzophenone was found in the larval exposure as well as a large amount of a very polar metabolite(s). Another new metabolite of the same chromatographic mobility as 2,2-dichloro-1,1-bis-(p-chlorophenyl) ethanol was found in the internal tissue extract upon adult topical exposure. (Auth.)

545* Rothe, C.F., Mattson, A.M., Nueslein, R.M., Hayes, W.J., Jr. METABOLISM OF CHLOROPHENOTHENE (DDT). A.M.A. Arch. industr. Hlth 16 (1957) 82-6.

Of the intestinally absorbed C^{14}-labelled DDT administered orally to rats with their thoracic lymph ducts cannulated, 47-65% was recovered in the chyle. Furthermore, 14-46% of the absorbed DDT-derived materials found in the chyle were dehydrohalogenated into a neutral material (DDE). (Auth. summary)

II-C-g PENTACHLOROPHENOL

546 Schmidt, L.H., Bubner, M. SYNTHESE VON PENTACHLORPHENOL-$^{36}Cl_{(s)}$. (The synthesis of pentachlorophenol labelled with Cl^{36} in Cl-5). Kernenergie 6, 2 (1963) 82. (In German).

This compound is used for wood protection against fungus and wood-boring insects. Synthesis is based on chlorination of the phenol and reduction of the Cl^{36}-labelled hexachlorophenol produced. It was carried out on a 100-mM-scale. Details of the procedure are given. A yield of 18 g (~68%, relative to phenol) was obtained; 160 μc of $NaCl^{36}$ were used, giving pentachlorophenol of a specific activity of 2 μc/g. Radiochemical yield was 22.5%, not allowing for recovered $NaCl^{36}$.

II-C-h TELODRIN

547 Stiasni, M. SYNTHESE VON TELODRIN-^{14}C UND DESSEN UMWANDLUNG DURCH MIKROORGANISMEN, MOSKITO-LARVEN UND RATTEN. (Synthesis of Telodrin-C^{14} and its transformation by microorganisms, mosquito larvae and rats). Thesis, Bonn, Universität, Organisch-Chemisches Institut. 1962. 68p. (In German).

A method for the microsynthesis of Telodrin (C^{14}-labelled in the hexachlorocyclopentane ring) was developed. C^{14}-labelled hexachlorocyclopentadiene reacts with 2,5-dihydrofurane to give the Diels-Alder-adduct R 67 which, on chlorination, gives C^{14}-labelled Telodrin. A 59% yield, relative to the pentadiene, with a specific activity of 8.9 mc/mM, was obtained. The microsynthesis of Telodrin-1,3-C^{14} (with a yield of ~10% relative to $KC^{14}N$, and specific activity 16.5 mc/mM) was repeated. Both products were purified by column chromatography, giving a purity > 99%. The synthesis products were checked against controls by thin-layer and column-chromatography. Telodrin-C^{14} and Telodrin-1,3-C^{14} give the same hydrophilic metabolite A when broken down by 4 different micro-organisms. Mosquito larvae break down metabolite A to ~20% of metabolite B, which is even more hydrophilic and consists of at least 3 components (57% BI, 23% BII, and 20% BIII). The hydrolysis product of BII was identified as Lacton I. BII and BIII were shown to be hydrolysable and to give rise to less hydrophilic compounds. The hydrolysis products of BI and BIII react with diazomethane to form less hydrophilic products. Stomach secretions in vitro do not affect Telodrin. The distribution of Telodrin-C^{14} in the organs and excrements of rats, following intravenous injection, was measured, and a metabolite of Telodrin was demonstrated in bile secretion. Only ~5% of the intravenously injected activity were eliminated in the course of 10 h.

II-C-j THIODAN

548 Gösswald, K. BEITRAG ZUR WIRKUNGSWEISE DES INSEKTIZIDE THIODANS®. (Further investigations into the mechanism of action of the insecticide Thiodan®). p.605-10 in "XI. Internationaler Kongress für Entomologie, Wien, 17 bis 25 August 1960. Verhandlungen. Band II (Symposien)". Wien, Organisationskomitee des XI. Internationalen Kongresses für Entomologie, Wien 1962. (In German).

Part of the paper is devoted to experiments with S^{35}-labelled Thiodan, an insecticide developed by Farbwerke Hoechst A.G. Its high vapour pressure allows application in the vapour phase which avoids possible contamination by direct contact. Experimental details are given. The uptake of the poison (not to be confused with its activity) is found to increase with increasing temperature and humidity. The technical product consists of 2 isomers with different melting points and different velocities of insecticidal effect. Experiments were continued with labelled α- and β-isomers and a (technical) mixture of equal specific activity. The α-isomer, with a higher vapour pressure than the β-, is taken up most rapidly and in the greatest quantity. The β-isomer appears to be specifically less effective. The lowest values were obtained for the mixture: it is therefore essential to repeat this work. Activity measurements carried out on dead and live insects showed that, for a limited period, the uptake of insecticide by the dead insects was greater than by the live ones. It is assumed that the soft radiation from S^{35} is primarily picked up from insecticide on the cuticle (the total activity requires wet-ash measurements). The development of higher temperatures inside the insect might lead to partial sublimation at the start due to metabolic processes. The temperature drops later. An insect which is still breathing may be assumed to breathe in an increased amount of insecticide, and dissolve it in the cuticular lipoids. Values obtained for radioactivity may be affected by a number of factors which must be taken into account in interpreting measurements.

549 Gösswald, K., Schulze, E.F., Kloft, W. PROBLEMS OF APPLICATION AND ACTION OF THIODAN STUDIED WITH S^{35}-LABELLED INSECTICIDE. p.241-7 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Using highly purified α- and β-isomers together with technical product, all labelled with S^{35} of the same specific activity (20 mc/g), problems of the application and mode of action of the isomers were studied. Since the insecticide can be experimentally applied in the vapour phase, the effect of different temperatures and air humidities on sublimation, and on penetration through the cuticula were tested. As intoxication began, a reactive increase in respiration, followed by a marked elevation of the insects' body temperature, were found. It was shown with labelled insecticides that this raising of body temperature after some time causes surface removal of the sublimated insecticidal substance by way of resublimation into the air. This mechanisms influences the complex mechanism of penetration, intoxication and detoxi-

cation in connection with temperature and relative humidity of the air. The main experiments were done with the granary weevil, Calandra granaria. Further experiments are concerned with the penetration and distribution of the labelled insecticide in the insect organism. (From auth.)

See also:

207 A new DDT-metabolizing enzyme in the German cockroach. (Agosin et al., 1961)
380 Lipids of DDT-resistant and susceptible larvae of Aedes aegypti. (Fast and Brown, 1962)
620 Metabolism and toxicity of the "Cyclodiene" insecticides. (Brooks and Harrison, 1963)
621 Fate of aldrin and dieldrin in locusts. (Cohen and Smith, 1961)
623 Absorption and metabolism of C^{14}-labelled DDT by DDT-susceptible and DDT-resistant pink bollworm adults. (Bull and Adkisson, 1963)
624 Density-mortality relations in mosquito bioassay. (Cutkomp and Wattal, 1963)
625 The metabolic fate of DDT-C^{14} in Triatoma infestans. (Dinamarca et al., 1962)
626 Factors involved in differential susceptibility of corn earworm larvae to DDT. (Gast, 1961)
627 Metabolism of dichlorodiphenyltrichloroethane in the German roach. (Hoskins et al., 1960)
628 Fate of DDT and toxaphene applied topically to susceptible and resistant boll weevils. (Lindquist et al., 1961)
629 The enzymatic in vitro degradation of DDT by susceptible and DDT-resistant body lice. (Perry et al., 1963)
634 Insecticides in metabolism. IV. Iridomyrmecin-(3-C^{14}). (Korte and Schreiber, 1962)
640 Biochemical study of a malathion-tolerant strain of Aedes aegypti. (Matsumura and Brown, 1961)
647 Final report on an investigation into the metabolism of insecticide R 6700, patent applied for, carried out for the firm Ruhrchemie AG., Oberhausen-Holten, by means of radioisotopes. (Becker et al., 1956)
653 Uptake of Telodrin by fall armyworm larvae exposed to residues. (Cox and Bowman, 1963)
654 Metabolism of aldrin and dieldrin by the American cockroach, Periplaneta americana (L.). (Hamilton, 1961)
655 Insecticides in metabolism. III. Microsynthesis of C^{14}-labelled Telodrin. (Korte and Stiasni, 1962)
658 Use of radioisotopes in studying the absorption, distribution and elimination of certain insecticides in animals. (Filatov et al., 1963)
660 Studies on the metabolism of aldrin-C^{14} in rats and rabbits. [Isolation of metabolities]. (Kochen, 1963)
664 Absorption, distribution, and elimination of α- and γ-benzene hexachloride. (Koransky et al., 1963)
667 A study of the absorption of ^{14}C-labelled DDT from water by fish. (Holden, 1962)
668 Uptake and detoxification of C^{14}-labeled DDT in Atlantic salmon. (Premdas and Anderson, 1963)
698 Translocation of γ-BHC in rice plant cultured in aqueous solution of C^{14}-γ-BHC. (Ishii and Hirano, 1962)
705 Factors contribution to the loss of insecticide deposits on cattle. (Roberts and Chamberlain, 1963)
706 Determination of residues of toxic principles in milk and meat by the use of radioactive indicators. (Kartashova and Kartashov, 1961)
708 In vitro stability and recovery of insecticides from milk. (Timmerman et al., 1961)
709 Insecticide residues. Procedure for cleanup of butterfat prior to analyses for dieldrin residues. (McKinley and Savary, 1962)
720 The application and measurement of labelled residual insecticides in some physico-chemical studies. (Phillips, 1963)
731 Extraction procedures for chloro-organic insecticides. (Klein et al., 1959)
733 Investigation into the problem of insecticide sorption by soils. (Gerolt, 1961)
734 Loss of parathion and DDT to soil from aqueous/dispersions and vermiculite granules. (Weidhaas et al., 1961)
1547 An isotope dilution technique was used to determine the γ-HCH content in commercial mixtures. (Sieber and Jumar, 1962)
1555 Some applications of radioisotopes to the study of the contamination of insects by insecticide solutions. (Lewis, 1963)

II-D Organophosphates

II-D-a GENERAL

550 Heath, D.F. ORGANOPHOSPHORUS POISONS. ANTICHOLINESTERASES AND RELATED COMPOUNDS. London, Pergamon Press. 1961. 403p.

Emphasis is given to fundamental aspects rather than to results of applied research (except when fundamental). The book is divided into 4 parts dealing with chemistry, biochemistry, pharmacology in mammals, and pharmacology in insects. Numerous studies in which use has been made of radioisotopes are quoted in the text.

II-D-b BAYCID

551 Fukuda, H., Masuda, T., Miyahara, Y., Tomizawa, C. FATE OF O,O-DIMETHYL O-(3-METHYL-MERCAPTOPHENYL) THIOPHOSPHATE SPRAYED ON RICE PLANTS. Jap. J. appl. Ent. Zool. 6, 3 (1962) 230-6. (In English).

Three kinds of rice plant (two varieties: Norin No.18 and Gaisenmochi) were used and sprayed with the (P^{32}-labelled) insecticide, Baycid. The hydrolysis rate of Baycid appeared to be less than that of methyl parathion or of malathion. Only 10% of chloroform-extractable metabolites remained after 6 h. Such metabolites consisted mostly of PS-sulfoxides and PS-sulfones, with scarcely any oxidation products in the PO-form. When Baycid was sprayed a few days before heading, the metabolites tended to accumulate in the ears and grain (7 ppm "Baycid" were detected in rice grains, 29 d after application). The metabolites in the grains were concentrated in bran not in polished rice or the husk. The water-extractable metabolites in the rice grains 14 d after application were separated by ion exchange chromatography, and the existence of phosphoric acid, O,O-dimethyl phosphoric acid, O,O-dimethyl thiophosphoric acid, O-methyl O-(3-methyl-4-methylmercaptophenyl) thiophosphoric acid and an unknown metabolite were found. The proportion of a monodemethylated compound in Baycid was unexpectedly high.

II-D-c BAYER S 4741

552 Tomizawa, C. RESIDUAL BEHAVIOUR OF O,O-DIMETHYL S-ISOPROPYL-2-SULFINYLETHYL PHOSPHOROTHIOLATE AND ITS ANALOGUES IN PLANTS. Jap. J. appl. Ent. Zool. 7, 2 (1963) 140-9. (In English).

This main constituent of the systemic (anti-mite- and aphid-) insecticide known as Bayer S 4741 was labelled with P^{32}. The degradation rate (examined by chloroform-water partition coefficient of radioactive material) in citrus leaves was the same for spray and topical application. In orange fruit, the residue (on 8th day post-application) in the peel was greater than in the juice. Residues and penetration are discussed for apple trees, radish, and sugar beet. After penetration of the insecticide into plant tissues, the mercaptosulfur moiety of the insecticide molecule was oxidized to produce the sulfone as in Systox. Phosphoric acid and dimethyl phosphoric acid were found as the hydrolysis products of the insecticide by ion exchange chromatography, and the production ratio of these metabolites was different among the test plants.

II-D-d BAYTEX

553 Shoffeitt, P.E. COMPARATIVE STUDIES WITH CERTAIN ANTIDOTES FOR ORGANOPHOSPHATE POISONING. Diss. Abstr. 23, 9 (1963) 3565-6.

One part of the work deals with the effect of SKF 525A (beta-diethylaminoethyl diphenylpropylacetate) on the metabolism of Baytex (O,O-dimethyl O-[4-(methylthio)-m-tolyl]phosphorothioate) by the white rat and the American cockroach, Periplaneta americana L., as investigated by means of P^{32}, column chromatography, infrared analyses, and cholinesterase assays. Baytex elimination from rats (urine, faeces) is discussed. Metabolites formed by phosphoryl sulfur and thiphenyl sulfur oxidation of Baytex by rats included the oxygen analogue, the sulfoxide and sulfone of the parent compound, the oxygen analogue sulfoxide, and the oxygen analogue sulfone. These oxidation products were isolated by selective solvent extraction, separated and characterized. The hydrolysis products of Baytex were dimethyl phosphorothioic

acid, and dimethyl phosphoric acid. Two hydrolysis products were not characterized. An increase in Baytex hydrolysis was observed in cockroaches pre-treated with SKF 525A, as compared with controls. SKF 525A did not, however, inhibit the oxidation of Baytex.

II-D-e BIDRIN

554 Menzer, R.E. METABOLISM OF RADIOLABELED 3-(DIMETHOXYPHOSPHINYLOXY)-N,N-DIMETHYL-cis-CROTONAMIDE (BIDRIN, SD 3562) IN BEANS AND MAMMALS. (Abstr. 51). Bull. ent. Soc. Amer. 9, 3 (1963) 163.

The in vivo metabolism of P^{32} and N-methyl-C^{14}-labelled Bidrin was studied. The main metabolite of toxicological interest in both plants and mammals was the des-N-methyl derivative of Bidrin which is of comparable toxicity to the parent compound. The fate of other fragments from the molecule will also be discussed.

II-D-f DEMETON

555 Groves, K., Haguwitz, R. PREPARATION OF LABELED 2-ETHYLTHIOETHANOL, A DEMETON INTERMEDIATE. J. agric. Food Chem. 9, 4 (1961) 262-3.

A small-scale synthesis of 2-ethylthioethanol by the catalytic condensation of ethylene oxide and ethyl mercapton is described. A S^{35} or C^{14} label may be incorporated in the alcohol, which is an intermediate in the preparation of demeton (O,O-diethyl O-ethylmercaptoethyl phosphorothioate). (From auth.)

II-D-g DIMETHOATE

556 Brady, U.E., Jr., Arthur, B.W. BIOLOGICAL AND CHEMICAL PROPERTIES OF DIMETHOATE AND RELATED DERIVATIVES. J. econ. Ent. 56, 4 (1963) 477-82.

Seventeen dimethoate derivatives were prepared in the laboratory, purified, and characterized. Derivatives containing dimethoxy groups were more effective against the house fly, Musca domestica L., than the diethoxy compounds. As the N-carbamoyl chain length increased in number of carbon atoms, the toxicity to house flies decreased; the monoalkyl-substituted amides were more effective than the dialkyl-substituted amides. Increase in chain length of the dialkoxy or N-carbamoyl groups resulted in increased stability to alkaline hydrolysis. The most toxic materials to the house fly were those having the C=O band between 5.90 and 5.95 μ. The absorption, distribution, metabolism, and excretion of P^{32}-labelled dimethoate were studied in rats and 3 species of insects (M. domestica L. Blatella germanica (L.), and Periplaneta americana (L.). Phosphorothioate oxidation was prevalent in rats, but the degrading rather than activating systems were predominant. Amidase activity was more pronounced in rats than in insects immediately following treatment with dimethoate; this major metabolic difference may partially explain selectivity. Phosphatase activity was also more evident in rats than in insects. (From auth.)

557 Casida, J.E., Sanderson, D.M. REACTION OF CERTAIN PHOSPHOROTHIONATE INSECTICIDES WITH ALCOHOLS AND POTENTIATION BY BREAKDOWN PRODUCTS. J. agric. Food Chem. 11, 1 (1963) 91-6.

Dimethoate* increases in toxicity to mammals on storage in certain hydroxylic solvents, particularly 2-alkoxyethanols. The reaction of dimethoate with 2-methoxyethanol at elevated temperatures yields at least 6 phosphorus-containing ionic products, 7 neutral phosphate esters other than the original compound, and the disulfide of N-methyl-mercaptoacetamide. P^{32}-labelled dimethoate was used (prepared, purified and characterized as described in J. agr. Food Chem. 7: 1959, 188). No evidence was obtained for the formation of stable pyrophosphates. The product of highest mammalian toxicity was a S-(N-methylcarbamoylmethyl) phosphorothiolate with one or both O-methyl groups replaced by O-(2-methoxyethyl) groupings. The toxicity to mammals of a few other phosphorothionate insecticides also increased on reaction with 2-methoxyethanol. Certain preparations of technical dimethoate contained an impurity, which somewhat increased the toxicity of dimethoate to several organisms, including the rats, following oral administration. Purified dimethoate reacted with lithium chloride or potassium O,O-dimethyl phosphorodithioate yielding a dimethoate potentiator, probably through O-demethylation as the initial reaction. (Mostly auth.)

* O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate

558 Pietri-Tonelli, P. de, Barontini, A. COMPORTAMENTO DEL ROGOR-P^{32} APPLICATO SULLE PIANTE. I. PENETRAZIONE E TRASLOCAZIONE DEL ROGOR-P^{32} APPLICATO SUL TRONCO DI PIANTE DI LIMONE. (Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment]. I. Penetration and translocation of Rogor P^{32} applied to the trunk of the lemon tree). Contr. Ist. Ric. agr., Soc. Montecatini 4 (1961) 39-52. (In Italian).

By means of radiological assays, bioassays and autoradiography it has been established that P^{32}-labelled Rogor, which is systemically effective against several species of pests feeding on the leaves, bark and fruits, when applied to the trunk or stem of lemon plants, is readily absorbed, transported mainly upwards and, together with its metabolites, translocated in high dosage into the branches and twigs, a very large amount into the leaves, in a smaller quantity into the flowers and fruits (more into the peel) and in a very low concentration into the roots. Only the initially formed xylem and the pith show no traces of P^{32}-containing substances since almost the entire amount (about 97%) of the applied insecticide leaves the treated area of the trunk and migrates into other organs. The upward movement occurs mainly through the xylem and less through the phloem in which, however, a relatively large amount of radioactive compounds accumulates by radial transfer from the xylem. The translocation into the roots takes place mostly through the phloem. (From auth. summary).

559 Pietri-Tonelli, P. de, Barontini, A. COMPORTAMENTO DEL ROGOR-P^{32} APPLICATO SULLE PIANTE. II. PENETRAZIONE E TRASLOCAZIONE DEL ROGOR-P^{32} APPLICATO SU PIANTE DI AGRUMI. (Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment] II. Penetration and translocation of P^{32}-labelled Rogor sprayed on crops.) Constr. Ist. Ric. agr., Soc. Montecatini 4 (1961) 53-64. (In Italian).

Further investigations were carried out on the distribution of the translocated material after the application of P^{32}-labelled Rogor (diluted with water to 0.05% - 0.1%) to the whole surface as well as only a part of the surface of leaves, fruits and twigs of citrus plants. There is evidence that, while the cell-to-cell movement into the tissues located just under the exterior parts which have been treated occurs over a very short distance but in relatively high concentration, the translocation through the vascular bundles occurs, on the contrary, over a great distance (mainly upwards and towards the growing organs) but, owing to the low dosage at which insecticide is applied, leads to relatively low concentrations of translocated material. (From auth. summary).

560 Pietri-Tonelli, P. de, Barontini, A. COMPORTAMENTO DEL ROGOR-P^{32} APPLICATO SULLE PIANTE. III. PENETRAZIONE E TRASLOCAZIONE DEL ROGOR-P^{32} APPLICATO PER IRRORAZIONE SU PIANTE ERBACEE ED ARBOREE. (Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment]. III. Penetration and translocation of P^{32}-labelled Rogor applied by spraying herbacious plants and trees). Italy. Istituto di Ricerche Agrarie. Laboratorio di Signa, Firenze. Montecatini, Società Generale per l'Industria Mineraria e Chimica - Milano. 1961. p.3-20. (In Italian, with English summary).

Autoradiographic and radiometric techniques were used for studying the distribution and translocation of Rogor in cotton and potato plants, fruit and leaves of olive trees, and fruit of peach sprayed with P^{32}-labelled Rogor. There is evidence that, following treatment, the insecticide and its metabolites occur in various concentrations throughout the various organs of the cotton plant, including the roots, and are concentrated in the bracteoles. These products also, systemically, reach the unsprayed bolls and leaves. (From auth. summary).

561 Pietri-Tonelli, P. de, Biondi, G., Barontini, A. ESPERIMENTI DI LOTTA CONTRO ALCUNE SPECIE DI COCCINIGLIE DEGLI AGRUMI. (Experiments on the control of some species of plant coccids). Italy. Istituto di Ricerche Agrarie. Laboratorio di Signa, Firenze. Montecatini, Società Generale per l'Industria Mineraria e Chimica - Milano. 1961. p.3-28. (In Italian, with English summary).

After a review of the means and methods, based on sprays with oils, organophosphorus compounds, and with oil-organophosphorus combinations which are more frequently recommended for the control of citrus scales, results are reported for laboratory investigations conducted to determine the activity of Rogor* (initial specific activity: 1.54 mc/mM) against some species of armoured and soft scales and mealybugs and to compare the effectiveness with that of parathion and other products. Data on field trials in citrus orchards infested by dicyctospermum (Chrysomphalus dicyctospermi Morg.), purple scale (Mytilococcus Beckii Newm.) and citrus mealybug (Pseudococcus citri Risso) are reported. Some work with P^{32}-labelled Rogor and autoradiography on the method of action of Rogor and parathion on C. dictyospermi indicated

* dimethoate [O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphoradithioate

that penetration of parathion occurs through the rostralis, as a stomach poison, and through the "armour" or scale covering, as a contact poison. Rogor, on the other hand, does not reach the body of the insect through the scale covering but is absorbed as a stomach poison after its penetration and translocation, for a short distance, into the mesophyll of the leaf.

562 Pietri-Tonelli, P. de, Barontini, A., Biondi, G. SYSTEMIC MIGRATION AND INSECTICIDAL ACTIVITY OF DIMETHOATE APPLIED ON TREE TRUNKS. p.407-32 in "New Developments, Including New Compounds, Novel Formulations, or New Application Methods - Session VIII". Soc. Montecatini, Institute of Agricultural Research, Signa Laboratory. Insecticide Group, 1961.

By using P^{32}-labelled dimethoate (initial specific activity 1.43 mc/mM) the concentration of some the translocated substances and the distribution of labelled compounds could be determined in many cases by radioanalysis and autoradiography. The relation between effectiveness and phytotoxicity of dimethoate applied to lemon, orange, tangerine, olive, apple, pear, cherry and peach are summarized in a table (p.418). In peach, following trunk application, the concentration of P^{32} percent as dimethoate and its degradation products (total P^{32}), and the concentration of P^{32} which could be extracted by means of chloroform and is present as dimethoate and its P = O metabolite ($P^{32}/CHCl_3$) were determined. The concentration of both total P^{32} and $P^{32}/CHCl_3$ reaches and maintains higher levels in the leaves (greater in the terminal leaves) than in the fruit. The temporal pattern of distribution of P^{32} in leaves and in fruit (also sectioned) is discussed in some detail (p.420; figs. 6, 7, 8). The adverse effects of trunk application, and the influence of the formulation on the effects on pests and plants are discussed. Even the least damaging among the solvents tested evidently permits the transfer of P^{32}-labelled dimethoate and its metabolites from the trunk to the leaves. The seriousness of the effect appears positively related to the speed of translocation of the active ingredient and to its maximum concentration in the leaves.

563 Santi, R. PENETRAZIONE, TRANSLOCAZIONE E METABOLISMO DEL ROGOR-P^{32} APPLICATO SUL TRONCO DI PIANTE DI LIMONE. (Penetration, translocation and metabolism of P^{32}-labelled Rogor applied to the trunk of the lemon tree). Italy. Istituto di Ricerche Agrarie. Laboratorio di Signa, Firenze. Montecatini, Società Generale per l'Industria Mineraria e Chimica - Milano. 1961. p.3-19. (In Italian, with English summary).

It was shown by radiometric, paper-chromatographic and autoradiographic methods that P^{32}-labelled Rogor (together with tri-n-butylphosphate), when applied to lemon tree trunks, was quickly absorbed into the inner parts and translocated, mainly upwards. Metabolism of Rogor followed essentially 2 routes: an oxidative one with formation of its P = O derivative, S 31 (N-monomethylamide of O,O-dimethyl thiophosphoracetic acid), and a hydrolytic one bringing about the formation of several products (O,O-dimethylphosphorothioic acid and O-methyl O-hydrogen S-(N-methylcarbamoylmethyl) phosphorodithioate). Extremely high concentrations of Rogor were found in the leaves, moderately high ones in twigs and rather low ones in fruit. Concentrations were higher in the skin of the fruit than in the endocarp. Small quantities of P^{32}-containing substances, not chemically identified but not Rogor or S 31, were found in the roots. Hydrolytic breakdown products extracted from leaves and made up mostly of O-methyl O-hydrogen S-(N-methylcarbamoylmethyl) phosphorodithioate or of O,O-dimethylphosphorothioic acid, or both, can be absorbed by the root system of young lemon plants and translocated towards the epigeic organs. (From auth. summary).

564 Santi, R., Giacomelli, R. METABOLIC FATE OF P^{32}-LABELED DIMETHOATE IN OLIVE FRUITS AND SOME TOXICOLOGICAL IMPLICATIONS. J. agric. Food Chem. 10, 3 (1962) 257-61.

Dimethoate was studied for use in the control of the olive fly, Dacus oleae (Gmel.), and proved to be both effective and safe. Metabolism of P^{32}-labelled dimethoate* in olives for eating and in olives yielding oil is very similar. In these fruits, dimethoate undergoes oxidation to the oxygen analogue (P=O derivative) [O,O-dimethyl S-methylcarbamoylmethyl phosphorothioate] and hydrolysis to degradation products such as phosphoric acid or methylphosphoric acid or both. When dimethoate is applied to olives for oil, according to the recommended schedule, the oil is practically free from toxic residues. When dimethoate is applied to eating olives, the usual industrial process with NaOH produces further degradation and a strong extraction of the P-containing insecticidal residues. (Essentially auth.)

* O,O-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate.

565 Santi, R., Radice, M., Giacomelli, R., Bazzi, B. STUDIO SUL METABILISMO DEL ROGOR-P^{32} NELLE BIETOLE DA ZUCCHERO E DA FORAGGIO. (Study on the metabolism of P^{32}-labelled Rogor in sugar and fodder beet). Italy. Istituto di Ricerche Agrarie, Montecatini, Societh Generale per l'Industria Mineraria e Chimica - Milano. 1962. p.3-22. (In Italian, with English summary).

Metabolism in the leaves was carried out by means of P^{32}-labelled active principle. Metabolism was found to follow essentially an oxidative and a hydrolytic course, with the formation of the P = O derivative, and of phosphoric acid, O,O-dimethylphosphoric acid, O,O-dimethylphosphorothioic acid and O-methyl, O-hydrogen of S-(N-methylcarbamoylmethyl) phosphorothioate respectively. The presence of 4 other P^{32}-labelled substances of unknown composition was also noted. The concentration of Rogor and its metabolites, known and unknown, varied in tissue with the time interval between treatment and sampling. Even long after treatment, the O,O-dimethylphosphorothioic acid is the component with the highest concentration in the leaves. Of the total P^{32} sprayed, only a small percentage was discovered in the roots of the field-grown sugar beet. It is essentially localized in the vascular tissue, and can be attributed to an unknown metabolite and to traces of O,O-dimethylphosphoric acid. The threshold of toxicity of Rogor and its P=O derivative for Aphis fabae was between 0.2 and 0.3 ppm. These levels are still present 26 d after treatment. There is a considerable safety margin from the health point of view in using Rogor as described. (From auth. summary).

566 Santi, R. PENETRATION, TRANSLATION, AND METABOLISM OF ROGOR-^{32}P APPLIED ON LEMON TREE TRUNKS. Contr. Ist. Ric. agr., Soc. Montecatini 5 (1961) 47-63. (In Italian).

Autoradiography, paper chromatography, and radiometry showed that a formulation of Rogor-P^{32} (I) with Bu_3PO_4 was quickly absorbed and translated, mainly upwards, when applied on lemon tree trunks. Metabolism of I followed 2 routes: (1) oxidination with formation of its P:O derivative. (II); (2) hydrolysis giving O,O-di-Me phosphoric acid, O,O-di-Me phosphorothioic acid, O-Me O-H S-(N-methylcarbamoylmethyl) phosphorodithioate, and H_3PO_4. Concentrations of I were extremely high in leaves, moderately high in twigs, and rather low in fruits, being higher in the skin than in the endocarp. Presence of I and II in the roots had to be excluded. (CA 60: 1964, 7384h)

II-D-h ETHION

567 Forman, S.E., Gilbert, B.L. ETHION-P^{32}_2. J. agric. Food Chem. 9, 4 (1961) 260-2.

The insecticide O,O,O',O'-tetraethyl S,S'-methylene biphosphorodithioate-P^{32}_2 (ethion-P^{32}_2) was prepared for use in biological studies. The product obtained from 3 c of $H_3P^{32}O_4$ contained 780 mc of P^{32} with a specific activity of 28.4 mc/g. When allowance is made for decay of the P^{32} (half-life 14.3 d), this quantity represents a radio-yield of 33%. Estimated vapour pressure of ethion was 1.5×10^{-6} mm at 25°C. (Auth.)

II-D-j FAMOPHOS

568 Sferra, P.R. METABOLISM OF FAMOPHOS IN MAMMALS AND INSECTS. (Abstr.49). Bull. ent. Soc. Amer. 8, 3 (1962) 155.

The rates of hydrolysis of tritiated Famophos, dimethyl 4-(dimethylsulfamoyl) phenyl phosphorodithionate, by whole insects and mammals were examined, and the results correlated with toxicity.

II-D-k FENTHION

569 Metcalf, R.L., Fukuto, T.R., Winton, M.Y. CHEMICAL AND BIOLOGICAL BEHAVIOR OF FENTHION RESIDUES. Bull. World Hlth Org. 29, 2 (1963) 219-26.

The activity of the insecticide fenthion, O,O-di-Me O-[4-(methylthio)-m-tolyl] phosphorothionate (I), was compared with those of its principal oxidation products. P^{32}-labelled I and its oxidation products were applied topically to 3 strains of houseflies and tested against larvae and adults of 2 species of mosquitoes. I and its products were separated by paper chromatography, using propylene glycol as the immobile phase on Whatman No.1; the mobile phase was hexane-toluene (7:3 vol/vol), saturated with the glycol. Spots were detected by spraying with 5% 2,4-dibromo-N-chloroquinone imine and heating,

and by bioassay, using mosquito larvae, of 1-cm sections of the paper strips. Results indicate that the oxidation products are unstable in H_2O and that I is a weak in vitro inhibitor of cholinesterase. I was unstable when exposed to sunlight and air, yielding 11 compounds, most of which are H_2O-soluble. Heating at 140° in an atmosphere of N caused a rapid breakdown of I, yielding the S-Me isomer primarily. Metabolism studies, using cotton plants and adult female houseflies, demonstrated that I is readily oxidized, as a surface residue or in plant and animal tissues, to sulfoxide and sulfone derivatives. (CA 60: 1964, 3433b)

II-D-1 LEBAYCID

570 Niessen, H., Tietz, H., Frehse, H. ÜBER DAS VORKOMMEN BIOLOGISCH AKTIVER UMWANDLUNGSPRODUKTE DES WIRKSTOFFS S 1752 BEI DER ANWENDUNG VON LEBAYCID. (On the occurrence of biologically active metabolites of the active ingredient S 1752 after application of Lebaycid®). Leverkusen, Höfchenbr. Bayer PflSchutz-Nachr. 15, 3 (1962) 129-51. (In German, with English summary).

The active ingredient is O,O-dimethyl-O-(3-methyl-4-methylmercaptophenyl-)thiophosphate (I). Following application of P^{32}-labelled Lebaycid (available at a specific activity of 3.4 mc/g) on plants (Phaseolus vulgaris), 4 oxidation products of S 1752, namely suphoxide (II) and sulphone (III) of S 1752 as well as sulphoxide (V) and sulphone (VI) of the oxygen-analogous phosphate form, were detected by paper chromatographic separation of purified plant extracts. By measuring the distribution of radioactivity on the paper chromatograms, it was possible to determine the 4 oxidation products quantitatively. The P^{32}-labelled active ingredient contained ~5% of S-methyl isomer VII. This compound is also oxidized to sulphoxide (VIII). Isomerization to S-methyl compounds in the plant was not observed, however. Immersion of the roots of young plants in Lebaycid emulsion and a study of the velocity of penetration after application on the leaf proved that the preparation has a slight systemic action. The quantitative study of the influence of light, plant enzymes and temperature on the transformation of S 1752 revealed that oxidation at the position of the methylmercapto group is chiefly due to the influence of light, while plant enzymes mainly oxidize the active ingredient at the position of the thiono-sulphur atom of phosphoric acid. Isomerization to S-methyl compounds takes place only at high temperatures.

II-D-m MALATHION

571 Giles, R.H., Jr., Peterle, T.J. DISTRIBUTION OF AERIALLY APPLIED MALATHION-S^{35} IN A FOREST ECOSYSTEM. p. 55-83 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

A faunal survey of two 20-acre watersheds was conducted during the summer of 1961. In May of 1962, one of the watersheds was treated with an application of 2 lb technical-grade malathion per acre in a formulation of xylene, triton X-155 emulsifier and water. S^{35}-labelled malathion (specific activity 17.5 mc/mM) was applied aerially (1 c of activity) to one of the 20-acre forested areas. The distribution of components of the aerial spray within the forest was measured. Electrically-operated air samplers provided estimates of drift off the area; helium-filled balloons bearing frosted-glass discs measured above-canopy application; glass discs suspended vertically as well as bark samples measured quantities settling out at different layers in the canopy; glass discs and spotting-enamel paper not only allowed a measure of horizontal distribution but a check of a standard spray-distribution detection device. Soil samples and monitoring of marked stakes allowed sub-surface distribution studies. Samples of water from the intermittent streams, insects, mammals, reptiles and birds indicated the initial and subsequent distribution of the insecticide and its metabolites in the ecosystem. Population studies of the faunal system continued throughout the summers of 1961-62 and a limited amount of survey data will be collected in the summer of 1963. Preliminary results indicate that the insect populations returned to normal in about 3 weeks and there was no detectable effect on the densities of the vertebrate animals on the sprayed area. (From auth.)

II-D-n PARATHION AND METHYL PARATHION

572 O'Brien, R.D. THE EFFECT OF SKF 525A (2-DIETHYLAMINOETHYL 2:2-DIPHENYLVALERATE HYDROCHLORIDE) ON ORGANOPHOSPHATE METABOLISM IN INSECTS AND MAMMALS. Biochem. J. 79 (1961) 229-35.

SKF 525A (2-diethylaminoethyl 2:2-diphenylvalerate hydrochloride) protects mice against poisoning by the 3 phosphorodiamidic compounds tested. Of the 8 phosphorothionates tested, protection against dimethoate only was observed. With houseflies and American cockroaches, SKF 525A gave no protection against any phosphorothionates. SKF 525A inhibited the conversion of parathion into paraoxon by mouse-liver slices or cockroach guts. SKF 525A inhibited the 'activation' of schradan by cockroach guts, as had previously been shown for rat-liver preparations. With mice and cockroaches in vivo, SKF 525A increased the concentration of paraoxon caused by the injection of parathion, and reduced the degradation of injected paraoxon. It was concluded that the diverse effects of SKF 525A on organophosphate toxicity in various species were due to the variations in the importance of inhibition of 'activating' as opposed to degrading enzymes. P^{32}-labelled parathion (0.1% in propylene glycol was used in the study and injected into mice and Periplaneta americana, at 5 mg parathion/kg. Labelled Paraoxon was prepared by passing N_2O_4 for 5 min at room temperature through a solution of labelled parathion in 10 ml methylene chloride, as a first step, 1 mg P^{32}-labelled paraoxon/kg was injected into the animals.

573 Knaak, J.B., Stahmann, M.A., Casida, J.E. PEROXIDASE AND ETHYLENEDIAMINETETRAACETIC ACID-FERROUS IRON-CATALYZED OXIDATION AND HYDROLYSIS OF PARATHION. J. agric. Food Chem. 10, 2 (1962) 154-8.

Peroxidase and the ethylenediaminetetraacetic acid-ferrous iron (EDTA-Fe^{+2}) complex were investigated for their ability to catalyze the oxidation and hydrolysis of parathion in the presence of an active hydrogen donor. Peroxidase catalyzed a 10% oxidation of parathion to para-oxon, while 12% conversion was maximum for the EDTA-Fe^{+2} complex. In addition to this oxidative conversion, peroxidase catalyzed the hydrolysis of 36% of the parathion and the EDTA-Fe^{+2} complex hydrolyzed 66%. Para-oxon was more stable than parathion to this hydrolytic attack. The EDTA-Fe^{+2} complex catalyzed 12% hydrolysis of paraoxon, whereas peroxidase catalyzed the hydrolysis of 6%. Peroxidases in plants may play a role in the metabolism of parathion and related phosphorothionates. P^{32}-labelled parathion and para-oxon were used. (From auth.)

574* Saito, T., Tomizawa, C. CERTAIN PROPERTIES OF METHYL PARATHION (EVAPORATION AND DEGRADATION OF MINUTE AMOUNTS AND CHANGES WHEN STORED IN DUSTS) EXAMINED BY TRACER TECHNIQUE. Botyu-Kagaku 25, 3 (1960) 85-90.

II-D-o PHOSPHAMIDON

575 Anliker, R., Beriger, E., Schmid, K. DIE SYNTHESE VON ^{14}C-MARKIERTEM PHOSPHAMIDON, EINEM NEUEN SYSTEMISCHEN INSEKTIZID. (The synthesis of C^{14}-labelled phosphamidon, a new systemic insecticide). Experientia 17, 11 (1961) 492-3. (In German).

Starting with C^{14}-labelled barium carbonate, phosphamidon III (O,O-dimethyl-O-[2-chloro-2-diethylcarbamoyl-1-methylvinyl]-phosphate) was synthesized in 6 steps (see Helv. chim. Acta 44: 1961, 1622). A yield of 64% was obtained, with the high specific activity of 12.1 mc/g.

576 Anliker, R., Beriger, E., Geiger, M., Schmid, K. ÜBER DIE SYNTHESE VON PHOSPHAMIDON* UND SEINEN ABBAU IN PFLANZEN. (The synthesis of phosphamidon and its decomposition in plants.) Helv. chim. Acta 44, 6 (1961) 1622-45. (In German, with English summary).

The synthesis of phosphamidon, a new systemic insecticide, is described. By use of the C^{14}-labelled compound it is shown that in the bean plant phosphamidon undergoes rapid degradation, during which traces of the metabolites desethylphosphamidon, α-chloroacetoaceto-diethylamide, and α-chloroacetoacetoethylamide only are detectable. In order to explain the mechanism of the degradation reactions, the behavior of phosphamidon towards acids and bases was studied. (Auth.)

* 2-chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate

II-D-p RUELENE

577* Muelder, W.W. 138th Meeting, American Chemical Society, New York, September 1960. Abstr. p.7A.

Means of synthesizing P^{32}-labelled Ruelene are described.

578 Timmerman, J.A., Jr. TOXICOLOGICAL STUDIES OF ORGANOPHOSPHATE ANTHELMINTICS. Diss. Abstr. 24, 5 (1963) 2196-7.

The metabolism, deposition of residues in tissues, excretion rates and stability of Ruelene® (4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate) and Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate) in sheep were investigated. In one experiment, P^{32}-labelled Ruelene (50 mg/kg) was administered orally. In other experiments, P^{32}-labelled Bayer 22408 and Ruelene were administered orally and the 4 sheep sacrificed 7 d after treatment. Ruelene residues in several tissues were below 0.4 ppm, while Bayer 22408 residues were below 1.0 ppm. Ruelene was degraded at the P-O-C and the P-N bond forming at least 8 hydrolytic products, 4 of which were identified. Bayer 22408 underwent oxidation at the P=S group and hydrolysis at the P-O-N bond. When Bayer 22408 and Ruelene were formulated as polymers and administered to sheep, there was reduced intestinal absorption of these toxicants, a decrease in the quantity of residues in internal tissues, the phosphate of the toxicants did not undergo enzymatic degradation, and a larger percentage of the administered material was eliminated in the faeces. The anthelmintic efficiency of Ruelene and Bayer 22408 formulated as polymers was compared with standard commercial wettable powder and liquid drench formulations.

II-D-q SARIN

579 Blank, I.H., Griesemer, R.D., Gould, E. THE PENETRATION OF AN ANTICHOLINESTERASE AGENT (Sarin) INTO SKIN. II. AUTORADIOGRAPHIC STUDIES. J. invest. Derm. 30 (1958) 187-91.

Sarin (isopropyl methylphosphonofluoridate), an esterase inhibitor similar to DFP, penetrates intact living skin. From the autoradiographic studies presented here, and from many others made in this laboratory, no evidence has been obtained to show that Sarin penetrates preferentially through the hair follicles. Penetration appears to be primarily transepidermal. The autoradiograms are similar whether Sarin is applied to the intact skin during life (rabbits) or to skin excised after death. Intactness of the barrier is important in limiting the penetration of Sarin through the skin. Evidence is shown that a considerable amount penetrates into the dermis during a period of only 5 min when there is even the most superficial break in the barrier. No such penetration through normal, unscratched skin could be demonstrated after 30 min. (Auth. concl.)

580 Fredriksson, T. PERCUTANEOUS ABSORPTION OF SARIN AND TWO ALLIED ORGANOPHOSPHORUS CHOLINESTERASE INHIBITORS. Acta derm.-venereol., Stockh., Suppl. 41 38 (1958) 88p. (In English).

The isopropyl (Sarin) (I), 1-methylbutyl (II), and 1-methylhexyl (III) derivatives of methylphosphonofluoridate were investigated. P^{32}-labelled inhibitors were synthesized according to Collomp (Bull. Inf. Scient. Min Guerre (Sect. tech. de l'Armée), Paris 1949, No.23 G, 1). I b_8 41°, n_D^{25} 1.3965, II $b_{4.5}$ 60°, n_D^{25} 1.3975, III $b_{0.5}$ 65°, n_D^{25} 1.4125. Percutaneous (Pc) absorption experiments are carried out with undiluted compounds. With dogs and cats no differences are noted between Pc addition and slow, intravenous infusion of I in regard to symptoms, respiratory and circulatory behaviour, or gross pathology. Acetyl-cholinesterase of arterial blood erythrocytes and butyryl-cholinesterase from plasma are inhibited to a maximum of 75% in 10-20 min following Pc I. Pc application elicits local muscular fibrillation and subcutaneous edema and hyperemia. Dilation and increased permeability of cutaneous blood vessels are explained by inhibition of acetylcholinesterase. Washing the guinea pig skin with a 5% soap solution after application of I enhanced survival. LD_{50} in the guinea pig in mg/kg body wt, for Pc application of the compounds to 0.4 cm are I 5.6, II 8.1, III 29.0; for intravenous injection of aqueous solutions, 0.027, 0.052, 0.104, and for subcutaneous injection of aqueous solutions 0.054, 0.069, 0.28, respectively. On using P^{32}-labelled compounds constants were obtained for their disappearance rates from the skin following Pc application: I 0.0010, II 0.0018, III 0.0008 min^{-1}. Radioactive material is found diffused throughout the dermis and concentrated in hair follicles. Butyrylcholinesterase from cat plasma was inhibited 50% by about 3×10^{-9} M I, II, or III. The acetylcholinesterase activity of the derma in different species was estimated for mouse, rat, guinea pig, rabbit, cat, and dog. The spontaneous hydrolysis of I, II, and III, 3.3×10^{-5} M in 0.1 M KCl, and their hydrolysis by homogenates of derma from the guinea pig were

determined at pH 7.5 and 37.0°C and expressed as half-life in min. The average for each was I 229 and 125, II 330 and 139, III 389 and 175, respectively. (From CA 55: 1961, 10716g)

581 McPhail, M.K., Adie, P.A. THE DISTRIBUTION OF RADIOACTIVE PHOSPHORUS IN THE BLOOD AND TISSUES OF RABBITS TREATED WITH TAGGED ISOPROPYL METHYLPHOSPHONOFLUORIDATE (Sarin). Canad. J. Biochem. Physiol. 38 (1960) 945-52.

Studies have been made of the penetration of P^{32}-labelled Sarin through the skin of rabbits. Sarin vapour at a constant concentration was passed through a plastic cup attached to the clipped bellies of rabbits. Using different sizes of cups it has been found that the L(ct)50 (concentration x exposure time required to kill 50% of the animals exposed) decreased as the exposure area was increased. From these experiments it was possible to determine how absorption through skin varies with area exposed, vapour concentration, and exposure time and to find the approximate ct necessary to kill a rabbit for any area of skin exposed. (Auth.)

II-C-r SCHRADAN

582* Rattan Lal, Rahalkar, G.W., Sethi, G.R., Saxena, P.N. STUDIES ON THE QUANTITATIVE UPTAKE OF P^{32}-LABELLED SCHRADAN BY ADULTS OF Dysdercus koenigii Fabricius FROM INSECTICIDAL FILMS. Indian J. Ent. 22, 2 (1960) 92-8.

Since little was known of the contact effect of schradan on insects or the extent to which they pick it up from deposits, schradan labelled with P^{32} was used to prepare films on filter papers, and adults of Dysdercus koenigii were released on these and observed for mortality daily at a temperature of about 30°C. Uptake was found to be directly related to the concentration of the solution used (0.543, 0.2715 or 0.116%) and to the duration of exposure, but it was also affected by the number of insects exposed per unit area. There was some variation in individual susceptibility of the insects, but the amount picked up from deposits of the higher concentrations was usually more than sufficient to kill them. After being picked up by contact, the insecticide became distributed in the body by way of the haemolymph, and it was eliminated to some extent with the excreta.

II-C-s SUMITHION

583 Kovac, J. DETERMINATION OF O,O-DIMETHYL O-(3-METHYL-4-NITROPHENYL) THIOPHOSPHATE IN TECHNICAL PRODUCTS AFTER PRIOR SEPARATION OF BY-PRODUCTS BY THIN-LAYER CHROMATOGRAPHY. J. Chromat. 11, 3 (1963) 412-3. (In German).

Technical O,O-Di-Me O-(3-methyl-4-nitrophenyl) thiophosphate (I), an insecticide, contains also varying amounts of O-Me O,O-bis(3-methyl-4-nitrophenyl) thiophosphate (II), O,O-di-Me O-(3-methyl-4-nitrophenyl) phosphate (III), 3-methyl-4-nitrophenol (IV), O-Me O,O-bis(3-methyl-4-nitrophenyl) phosphate, and several S-alkyl isomers which interfere in the direct determination of I by polarography. These by-products are separated from I by thin-layer chromatography on SiO_2 with petroleum ether (b. 60-80°) containing 1.4 volume % acetone. R_f values of 0.71, 0.36, 0.06, and 0.16 were obtained for I, II, III, and IV, respectively. The by-product spots, viewed in ultraviolet light, are eluted from the plate with MeOH and determined polarographically in toto, and the curve obtained is subtracted from that of the technical product to give the I content. The maximum error of the method is ± 2%. S^{35}-labelled I in technical I may be purified by paper chromatography with the system olive oil-AcOH, dissolved in hexane, and shaken with an equal volume of MeCN; I remains in the MeCN layer and the oil remains in the hexane layer. The partition coefficient of I in this system is 38. (CA 59: 1963, 14511h)

584 Miyamoto, J., Sato, V., Kadota, T., Fujinami, A., Endo, M. STUDIES ON THE MODE OF ACTION OF ORGANOPHOSPHORUS COMPOUNDS. PART I. METABOLIC FATE OF P^{32}-LABELED SUMITHION AND METHYL PARATHION IN GUINEA PIG AND WHITE RAT. Agric. Biol. Chem., Japan 27, 5 (1963) 381-9.

An explanation was sought of the low mammalian toxicity of Sumithion® [O,O-dimethyl O-(3-methyl-4-nitrophenyl) phosphorothioate, also known as Bayer 41831 or Folithion]. Experiments were made using P^{32}-labelled Sumithion and methyl parathion on guinea pigs, rats, the German cockroach, Blattella germanica (L.), and rice followed by chromatographic separation and identification of metabolites in the

excreta. Results of such in vivo studies indicated that the comparatively low mammalian toxicity of Sumithion is probably due to the ability of the mammal to degrade the insecticide in a more efficient manner than insects.

II-D-t THIMET

585 Costa, J.J., Gheifi, R.A., Brenzoni, E.O. PENETRACION Y TRASLACION DE UN INSECTICIDA SISTEMICO. Informe No.18. Argentina. Comisión Nacional de Energía Atomica, Buenos Aires. 1963. 19p. (In Spanish, with English summary)

P^{32}-labelled Thimet (phorate) was applied to barley plants in a greenhouse experiment, by either painting the leaves, irrigating the soil, or treating the seeds. Autoradiographs confirmed penetration in every case, with translocation throughout the entire plant and a markedly higher level of radioactivity in the upper part of the leaves. Optimum insecticide concentrations, such that the plant was not damaged, with yet enough to obtain satisfactory autoradiographs (phorate 1.1 mc/mM), were found to be as follows: topical application to leaves 2 ‰ of the product in an emulsion consisting of a derivative of sulphonated polyethyleneglycol, xylol, and water; irrigation - same emulsion but 0.4% phorate; seed treatment - same emulsion but 0.2% phorate when the seeds were soaked, and 2% (with reference to seed weight) when activated charcoal was used.

II-D-u TROLENE

588 Adkins, T.R. Jr. SYSTEMIC ACTION OF TWO INSECTICIDES ON ARTHROPOD PARASITES OF RABBITS AND CATTLE. Diss. Abstr. 21, 12 (1961) 3890-1.

Experiments were conducted on the toxicity of Dipterex (Bayer L 13/59; O,O-dimethyl-2,2,2-trichloro-1-hydroxyethyl-phosphonate) to Amblyomma maculatum Koch, and of Trolene (Dow ET-57; O,O-dimethyl-O-2,4,5-trichlorophenyl-phosphorothioate) against Hypoderma lineatum (DeVill.). Part of the thesis is concerned with investigations into the systemic action of P^{32}-labelled Trolene in domestic rabbits. These were treated with 50, 75, 100 and 200 mg radioactive Trolene/kg body weight. Blood samples were collected from the marginal ear vein at intervals, and simultaneously 5th-instar bed bugs (Cimex lectularius) were allowed to take blood meals from the treated rabbits. Percentage mortalities of these bugs were used for bioassay studies. The quantity of radioactive material in the blood fluctuated (3 or 4 peak concentrations but no levelling off). Bioassay indicated fluctuating levels of toxicant, not consistently correlated with radiological assay. Some mechanism might limit the absorption of chemical through the gut wall into the blood stream. When concentrations of radioactive material in the blood reached high levels, bleeding was difficult, blood proved more viscous and clotted faster than normal, and bugs fed slowly or not at all. Rabbits died when the radioactive chemical in the blood reached the concentration levels 18.6, 23.6, 41.6, 72.4, and 107.0 µg equiv./ml.

II-D-v VARIOUS

587 Dedek, W. DIE DARSTELLUNG ^{32}P-MARKIERTER PHOSPHORBROMIDE ALS AUSGANGSSUBSTANZEN FÜR SYNTHESEN ^{32}P-MARKIERTER PHOSPHORORGANISCHER INSEKTIZIDE. (Preparation of P^{32}-labelled phosphorus bromides as starting materials for the synthesis of P^{32}-labelled organo phosphorus insecticides). Isotopen Tech. 1, 7 (1961) 195-6. (In German).

Detailed procedures are given for the preparation of products with specific activities dependent only on the yield of the reaction and the specific activity of the labelled P used. $P^{32}Br_3$ was prepared in 80-5% yield from labelled red P and Br in CS_2. $P^{32}Br_5$ was prepared similarly and treated drop-wise, with cooling, with a solution of absolute EtOH in CS_2 to give 82-5% $P^{32}OBr_3$. $P^{32}SBr_3$ was prepared in 57-9% yield by adding Br to a suspension of red P^{32}, S, and $AlCl_3$ in CS_2. (CA 56: 1962, 15120g)

588* Russin, K., Szuchnik, A. PREPARATION OF SODIUM α-NAPHTHYL PHOSPHATE AND PHOSPHORUS OXYCHLORIDE LABELLED WITH P^{32}. NP-8155, Atomic Energy Commission, Washington, D.C. 1959. 10p.

A semi-micromethod for the preparation of P^{32}-labelled di-Na α-naphthyl phosphate and $POCl_3$ from hydrated labelled H_3PO_4 and PCl_5 is presented. This represents a stepping stone in the synthesis of labelled organophosphorus insecticide.

589* Kalinsky, J.L., Weinstein, A. IMPROVED PROCEDURE FOR SYNTHESIS OF P-32 PHOSPHORUS OXYTRICHLORIDE. J. Amer. chem. Soc. 76 (1954) 5882.

As a starting point for the synthesis of certain P^{32}-labelled insecticides phosphorus oxytrichloride is required. A method is described, starting with the dehydration of aqueous $H_3P^{32}O_4$ for obtaining $P^{32}OCl_3$ of high specific activity (0.76 mc/mM) and chemical purity (97±1%). The specific activity was determined by conversion into P^{32}-labelled tricresyl phosphate and subsequent assay.

Phosphoric acid esters

590 Dedek, W., Grimmer, F., Koch, H. RADIOAKTIV MARKIERTE PHOSPHORSÄUREESTER. I. MITTEILUNG: DARSTELLUNG DER ^{32}P-MARKIERTEN ISOMEREN DES β-METHYLMERCAPTOÄTHYL-THIOPHOSPHORSÄUREDIMETHYLESTERS UND IHR HYDROLYTISCHER ABBAU IN DER PFLANZE. (Radioactive-labelled phosphoric acid esters. I. Preparation of P^{32}-labelled isomers of the β-methylmercaptoethyl thiophosphoric dimethyl ester and their hydrolytic breakdown in the plant). Isotopen Tech. 2 (1962) 150-7. (In German).

The various steps in the synthesis of this systemic insecticide are described, and details of the chromatographic separation procedure given. The hydrolytic breakdown products of the P^{32}- and S^{35}-labelled isomers and of their oxidation products are traced. Tomato plants were treated in the field and their residue analyzed subsequently.

591 Dedek, W. RADIOAKTIV MARKIERTE PHOSPHORSÄUREESTER. II. MITTEILUNG. DARSTELLUNG UND HYDROLYTISCHER ABBAU VON ^{32}P-MARKIERTEM DIPTEREX. (Radioactive-labelled phosphoric acid ester. II. Preparation and hydrolytic breakdown of P^{32}-labelled Dipterex). Isotopen Tech. 2, 6 (1962) 182-5. (In German).

The preparation is described of P^{32}-labelled phosphorus trichloride ($P^{32}Cl_3$) which, in turn, can be used to give dimethyl phosphite $(CH_3O)_2P^{32}(=O)H$ from which Dipterex $(CH_3O)_2P^{32}(=O)CH(OH)\text{-}CCl_3$ and DDVP (dimethylchlorovinyl phosphate) $(CH_3O)_2P^{32}(=O)O\text{-}CH{=}CCl_2$ can be obtained. Selective extraction of Dipterex breakdown products from an aqueous solution is described.

592 Dedek, W., Kühnert, M. RADIOAKTIV MARKIERTE PHOSPHORSÄUREESTER. III. MITTEILUNG: DAS VERHALTEN VON ^{32}P-MARKIERTEM WOTEXIT BEI INTRAVENÖSER UND INTRAMUSKULÄRER INJEKTION AN RINDERN. (Radioactive-labelled phosphoric acid esters. III. The fate of P^{32}-labelled Wotexit following intravenous or intramuscular injection in cattle). Isotopen Tech. 2, 6 (1962) 307-9. (In German).

Four experiments were carried out with intravenous and three with intramuscular injection of "Bubulin" which contains Wotexit (O,O-dimethyl-1-hydroxy-2,2,2-trichloroethylphosphonate). The data obtained from the different series are plotted. The radioactivity of extracts was corrected by a distribution coefficient. Results indicate the absence of serious persisting side effects when "Bubulin" is injected.

593 Kovac, I., Novomeska, E. REPORT ON THE SYNTHESIS AND APPLICATION OF P^{32}-LABELLED DIALKYLDITHIOPHOSPHORIC ACID ESTERS. Sektion Chemie im Rat für gegenseitige Wirtschaftshilfe, Sofia 1961.

Thiophosphoric esters

594 Dubini, M. SYNTHESIS OF THIOPHOSPHORIC ESTERS LABELED WITH ^{32}P. Ann. Chim., Rome 53, 10 (1963) 1421-6.

$(MeO)_2P^{32}(S)SCHPhCO_2Et$ (I) and $(MeO)_2P^{32}(O)SCHPhCO_2Et$ (II), useful for the biochemical study of the analogous inactive compounds, that have interest as insecticides were prepared. To prepare I (Ital. 561 501) 0.45 g red irradiated P and 1.18 g S was heated 3 h at 300° in CO_2 atmosphere and cooled, 10 ml toluene and 2 ml anhydrous MeOH added, and the mixture maintained 3 h at 80°. The filtered liquid was agitated

with N to eliminate H_2S, then 2 ml H_2O with phenolphthalein added, and the solution neutralized with NaOH. The aqueous layer was separated, 2.62 g $BrCHPhCO_2Et$ and 4 ml acetone added, the solution agitated 22 h at ambient temperature, 10 ml toluene added, and agitation continued 30 min. The organic layer was dried over anhydrous Na_2SO_4, filtered, chromatographed (acid alumina), and distilled in a rotating evaporator at 80–100°/1 mm to eliminate solvent and Br derivative and to yield 2.52 g I, n_D^{20} 1.5538. To prepare II (Ger. 1,011,416, CA 54, 24651e), $(MeO)_2P^{32}ONa$ was prepared by irradiation of the compound followed by distillation to eliminate decomposition products and, by P^{32} exchange with $H_3P^{32}O_4$. An acid solution of carrier-free $H_3P^{32}O_4$ (0.2 ml) (activity 0.5 mc) and 0.6 ml H_3PO_4 was evaporated 10 h in vacuo, then 4.9 g $(MeO)_2PONa$ added, the whole heated in a closed tube 24 h at 70–80°, the organic layer distilled at 18 mm, and the radioactivity determined (1.5% introduced). MeOH (12 ml) and 310 mg Na was agitated until complete solution of Na in N atmosphere and cooled to 0.5°, 1.5 g activated $(MeO)_2PONa$ added under a slow current of N, the mixture agitated 2 h, treated with 435 mg S powder, agitated 3 h at 0.5° and 15 h at ambient temperature, filtered, and evaporated in vacuo, anhydrous ether added, the product filtered off after 4 h and treated with 9 ml $BrCHPhCO_2Et$, the mixture agitated 2 h at 70°, 5 ml water added, the organic layer extracted with Et$_2$O, dried (Na_2SO_4), and evaporated, and the residue distilled at 170–80°/1 mm to give 1.9 g II, n_D^{26} 1.5220. (CA 60: 1964, 6777f)

595 Fontana, P., Silva, S. ASSORBIMENTO RADICALE DI O,O DIMETIL-S-BENZEN SOLFONIL DITIOFOSFATO CONTENENTE ^{32}P. (Radical absorption of P^{32}-labelled O,O-dimethyl-S-benzene sulfonyl phosphorodithioate). Energia nucl., Milano 10, 3 (1963) 141–5. (In Italian, with English summary).

Procedures for the synthesizing the P^{32}-labelled insecticide were studied and the compound administered to tomato plants (Licopersicon esculentum) in order to follow its radical absorption. The pesticide is absorbed only slightly and only shortly after treatment, and undergoes rapid and conspicuous hydrolysis both in the soil and the plant itself.

See also:

500 A new bioassay technique, with special reference to the specific bioassay of DDVP insecticide. (Sun and Johnson, 1963)

630 Distribution and metabolism of P^{32}-labeled diisopropyl phosphorofluoridate in the American cockroach, Periplaneta americana. (Iyatomi et al., 1957)

631 Mechanisms of resistance in Diazinon-selected multi-resistant Musca domestica. (Forgash et al., 1962)

632 Absorption and metabolism of dimethoate(^{32}P) in the bollworm and boll weevil. (Bull et al., 1963)

633 Metabolism of Imidan in insects. (Menn and McBain, 1963)

636 Metabolism of malathion and malaoxen by the mosquito, Culex tarsalis Coq. (Bigley and Plapp, 1962)

637 Metabolism of malathion in susceptible and resistant house flies. (Bigley and Plapp, 1963)

638 The permeability of insect cuticle. (Matsumura, 1959)

640 Biochemical study of a malathion-tolerant strain of Aedes aegypti. (Matsumura and Brown, 1961)

641 Histochemistry of malathion resistance in the encephalitis mosquito, Culex tarsalis Coq. (Mengle and Lewallen, 1962)

642 Metabolism of malathion by a resistant and a susceptible strain of Culex tarsalis: I. Degradation in vivo and identification of organic soluble metabolites. (Mengle and Lewallen, 1963)

643 Selective toxicities of organic phosphorus insecticides. III. An enzyme system included in the cleavage of methyl parathion to demethyl parathion in the supernatant of some types of homogenates. (Fukami and Shishido, 1963)

644 The uptake and metabolism of parathion by insect eggs. (O'Brien and Smith, 1961)

645 Studies on parathion metabolism in normal and parathion-resistant house flies. (Plapp et al., 1961)

646 The toxicological action of three organophosphorus insecticides with three species of mosquito larvae. (Schmidt and Weidhaas, 1961)

649 Absorption and metabolism of Ruelene by arthropods. (Brady and Arthur, 1962)

650 Distribution of P^{32}-labelled schradan in the American cockroach Periplaneta americana (L.) (Saito, 1960)

651 Distribution of P^{32}-labelled schradan in various insects [Periplaneta americana (L.), Musca domestica L., Chilo suppressalis (Wlk.), Nephotettix cincticeps (Uhl.), Scotinophara lurida (Burm.) and Leptocorisa varicornis (F.)]. (Saito, 1960)

652 Studies on the selective toxicity of schradan. (Saito, 1963)
656 The penetration and metabolism of Thiodan in M. domestica. (Barnes, 1963)
658 Use of radioisotopes in studying the absorption, distribution and elimination of certain insecticides in animals. (Filatov et al., 1963)
661 Metabolism of O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate by white rats. (Brady and Arthur, 1961)
663 Studies with P^{32}-labeled Bayer 22408 in steers and guinea pigs. (Gatterdam et al., 1962)
666 Metabolism as factor in selectivity of organophosphate insecticides. (Krueger, 1961)
669 Leukokinetic studies. V. Uptake of tritiated diisopropyl fluorophosphate (DFP) by leukocytes. (Kurth et al., 1961)
670 The distribution and excretion of P^{32}-labeled diazinon in guinea pigs. (Kaplanis et al., 1962)
671 Detection and distribution of ^{32}P labelled diazinon in dog tissues after oral administration. (Millar, 1963)
672 Rumen bacterial and protozoal responses to insecticide substrates. (Williams et al., 1963)
673 The metabolism of P^{32}-labeled dimethoate in sheep. (Chamberlain et al., 1961)
674 Studies on influencing metabolism and on the precipitation mechanism of the phosphonic acid ester, trichlorphon in the commercial product "Bubulin" with the help of ^{32}P-labelled phosphor in the intravenous and intramuscular injection to cattle. (Kühnert et al., 1963)
675 Absorption and elimination of General Chemical 4072 applied dermally to cattle. (Chamberlain and Hopkins, 1962)
676 The metabolism of orally administered malathion by a lactating cow. (O'Brien et al., 1961)
677 New tracer techniques for evaluating the effects of an insecticide on the ecology of a forest fauna. (Peterle and Giles, 1961)
678 Studies on the percutaneous absorption of parathion and para-oxon. II. Distribution of ^{35}P-labelled parathion within the skin. (Fredriksson and Bigelow, 1961)
679 Tissue distribution of P^{32}-labeled parathion. Autoradiographic technique. (Fredriksson and Bigelow, 1961)
680 Penetration and metabolism of two organophosphorus insecticides by the organs of warm blooded animals. (Gar et al., 1958)
682 Metabolism of 2,2-dichlorovinyl dimethyl phosphate in relation to residues in milk and mammalian tissues. (Casida et al., 1962)
683 Mammalian enzymes involved in the degradation of 2,2-dichlorovinyl dimethyl phosphate (DDVP). (Hodgson and Casida, 1962)
684 Metabolism of organophosphate insecticides by plants: a review. (Casida, 1962)
685 Annual Report of the West African Cocoa Research Institute, 1959-60. (West African Cocoa Research Inst. 1961)
686 Studies on the translocation of radioactive schradan in plants and its uptake from film by insects. (Chatterji et al., 1961)
687 Phorate accumulation by cotton plants and recovery from soil. (Hacskaylo et al., 1961)
688 Dimethoate absorption and its translocation and distribution in the cotton plant. (Hacskaylo et al., (1961)
689 Metabolism of dimethoate in cotton leaves. (Hacskaylo and Bull, 1963)
690 Evolution des dépôts superficiels, diffusion et dégradation de deux insecticides endothérapiques: le déméton-S et l'endothion dans quelques plantes maraîchères. (Hascoët, 1963)
691 Absorption and translocation of phorate and phosphorus by cotton seedlings. (Lindquist et al., 1961)
692 Laboratory and field investigations with phorate-treated cotton seeds. (Lindquist et al., 1961)
693 Systemic activity of dimethoate applied to cotton seeds. (Lindquist et al., 1961)
694 Absorption and translocation of Di-Syston by cotton plants. (Tsao and Clark, 1961)
695 Absorption and movement of phosphorus-32-labelled systemic insecticides in the grape vine (Vitis vinifera L.) (Coombe, 1962)
697 L'établissement des processus d'absorption et diffusion des insecticides systémiques au Populus euramericana dode Guinier "robusta". (Catrina et al., 1963)
699 Metabolic fate of malathion and methyl parathion in rice plant. (Tomizawa and Sato, 1962)
700 Fate of O,O-dimethyl O-(3-methyl-4-methylmercaptophenyl) thiophosphate sprayed on tea and cabbage leaves. (Tomizawa et al., 1962)
703 Residue and metabolism of radioactive 4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate administered as a single oral dose to sheep. (Bauriedel and Swank, 1962)
707 Residues in the milk of dairy cows sprayed with P^{32}-labeled general chemical 4072. (Roberts et al., 1961)

709 In vitro stability and recovery of insecticides from milk. (Timmerman et al., 1961)
712 Magnitude and nature of residues in tissues and eggs of poultry receiving Ruelene in the feed. (Buttram and Arthur, 1961)
713 Residues in tissues and eggs of poultry dusted with Co-Ral (Bayer 21/199). (Dorough et al., 1961)
714 Residues in tissues and eggs of poultry receiving Co-Ral (Bayer 21/199) in the feed. (Dorough et al., 1961)
715 Distribution and solubility properties of phosphoric and O,O-diethyl phosphorodithioic acids fed to laying hens. (Dorough and Arthur, 1961)
716 Percutaneous absorption of parathion and paraoxon. IV. Decontamination of human skin from parathion. (Fredriksson, 1961)
718 The detection of residues of Systox and its toxic metabolites in the presence of other organophosphorus pesticides. (Adams et al., 1963)
719 Elimination of residual agricultural chemicals. II. Contamination with Baycid (O,O-diethyl O-(3-methyl-4-methylthiophenyl) thiophosphate). (Danbara and Tomizawa, 1961)
723 Method of determining residues of the insecticide Lebaycid® in plant material. (Frehse et al., 1963)
724 Accumulation of phorate by cotton plants from solution and sand culture. (Hacskaylo et al., 1961)
725 Locale and metabolism of methyl parathion and guthion in the cotton leaf. (Shipp, 1963)
726 Characteristics of residues of methyl parathion applied to field cotton. (Shipp et al., 1963)
727 Residue determinations in olives and various parts of plants of the N-monomethylamide of O,O-dimethyldithiophosphoryl acetic acid (Rogor). (Bazzi, 1960)
728 Determination of residues of ethyl ester of O,O-dithiophosphorylacetic acid [Cidial] in agricultural products. (Bazzi, 1963)
729 The Agricultural Research Institute of the Society of Montecatini: Data on phosphoric ester insecticides in plants and residue evaluations. (Bazzi, 1963)
730 Method of determining residues of the insecticide Lebaycid® in olives and olive oil. (Frehse et al., 1963)
734 Loss of parathion and DDT to soil from aqueous dispersions and vermiculite granules. (Weidhaas et al., 1961)
1570 Use of radioisotopes and radiation in the control of plant and animal insect pests. (Andreev, et al., 1963)

II-E Pyrethrins and Related Compounds

II-E-a PYRETHRINS

596 Fine, B.C., Godin, P.J., Thain, E.M. PENETRATION OF PYRETHRIN I LABELLED WITH CARBON-14 INTO SUSCEPTIBLE AND PYRETHROID RESISTANT HOUSEFLIES. Nature, Lond. 199, 4896 (1963) 927-8.

(C^{14})-pyrethrin I, labelled in the cyclopropane ring adjacent to the ester linkage, was prepared by the esterification of (C^{14})-(±)-trans-chrysanthemum monocarboxylic acid with (+)-pyrethrolone. Details of the procedure are given. Because of the small quantity of material available the (±)-trans-acid could not be resolved and so the final product was a mixture of natural pyrethrin I and one of its diastereoisomers, henceforth referred to as (C^{14})-'pyrethrin I'. Sub-lethal quantities of (C^{14})-'pyrethrin I' in acetone were then applied by topical application to batches of flies of three strains. Results indicate that there is a definite correlation between the rates of absorption of (C^{14})-'pyrethrin I' and pyrethroid resistance in the strains studied here.

597 Godin, P.J., Thain, E.M. BIOSYNTHESIS OF CHRYSANTHEMUMMONOCARBOXYLIC ACID. Proc. chem. Soc. (1961) 452.

Pyrethrin I, labelled with C^{14} derived from mevalonic acid-2-C^{14} in vivo (CA 56, 724f), yielded chrysanthemummonocarboxylic acid-C^{14} (I) on alkaline hydrolysis without loss of radioactivity. Ozonolysis of I gave Me_2CO-C^{14} and caronic acid-C^{14} (II). Me_2CO was converted to $C^{14}HI_3$ and Kuhn-Roth oxidation of II gave AcOH with 50% of the radioactivity of II. This confirmed the sites of C^{14}-labelling in I to be as shown and established that I was formed in the plant from two isoprenoid units. (CA 56: 1962, 11462c)

598* Levy, W.L., Munou, M.O., Muggia, F.M., Jimenez, J.O. Pyrethrum Post 5 (1960) 3-7

On the breakdown and synthesis of naturally occurring pyrethrum insecticides.

II-E-b ROTENONE

599 Nishizawa, Y., Casida, J.E. RADIOSYNTHESIS OF ROTENONE-8-C^{14}. (Abstr. 64). Bull. ent. Soc. Amer. 9, 3 (1963) 164.

Reaction of ethyl bromoacetate-1-C^{14} with derrisol yielded dehydrorotenone-8-C^{14} in 50% yield. Sodium boron hydride reduction gave rotenol, and subsequent Oppenauer oxidation yielded mutarotenone-8-C^{14} (see Miyano and Matsui, Berg. 91: 1958, 2044) in about 25% yield. Heating the mutarotenone gave natural rotenone-8-C^{14} in about 10% overall yield from ethyl bromoacetate-1-C^{14}.

II-F Nicotine. Carbamates and Other Compounds

II-F-a NICOTINE

600 Griffith, G.D. THE BIOLOGICAL OXIDATION OF NICOTINE. I. NICOTINE DEGRADATION BY Nicotiana rustica. II. NICOTINE DEGRADATION BY AN Arthrobacter SPECIES. Diss. Abstr. 22, 2 (1961) 416.

Metabolism of nicotine in the tobacco plant has remained largely unexplored, although it has been demonstrated that the alkaloid is not an inert plant constituent but can be converted to other materials. In the present study C^{14}-labelled nicotine was supplied to tobacco plants and nicotine, nicotinic acid, and cotinine were isolated after periods of metabolism of 4, 7, or 14 d. Approximately 60-80% of the total radioactivity fed to the plants was recovered as nicotine dipicrate in all experiments. Nicotinic acid isolated as the hydrochloride, contained a significant amount of isotope. The production of nicotine acid from nicotine in the tobacco plant suggests that the alkaloid may serve as a reserve source of this compound. A species of Arthrobacter resembling Arthrobacter oxydans was isolated in the nutrient medium in which tobacco plants had been grown. The bacteria catalyzed the production of 6-hydroxynicotine in approximately 50% yield from nicotine in a medium containing nicotine, inorganic salts and a small amount of yeast extract. The significance and implications of the findings are discussed.

601 Griffith, T., Byerrum, R.U. BIOSYNTHESIS OF THE PYRIDINE RING OF NICOTINE FROM SUCCINATE AND ACETATE. Biochem. Biophys. Res. Commun. 10 (1963) 293-7.

Tobacco plants (Nicotiana rustica) were fed acetate-2-C^{14} (I) and succinate-2,3-C^{14} (II). Specific degradations of nicotine were carried out for isolation and assays of carbons 2, 3, and 6 of the pyridine ring. With I, the percent distribution of activity was 38, 34, and 11, respectively, and with II, 39, 39, and 7. It is suggested that carbons 2 and 3 of the pyridine ring arise from the methylene carbons of succinate or a closely related acid. (CA 58: 1963, 14358c)

602 Il'in, G.S., Feier-Kossei, O.G. INFLUENCE DU CHLORAMPHÉNICOL SUR LA BIOSYNTHÈSE DE LA NICOTINE. Dokl. Akad. Nauk SSSR 153, 2 (1963) 470-2. (In Russian, with French summary).

603 Il'in, G.S. BIOSYNTHESIS OF NICOTINE IN THE TOBACCO PLANT. Fiziol. Rast. 10, 1 (1963) 79-83. (In Russian, with English and French summaries).

In experiments with Nicotiana tabacum, intensive synthesis of nicotine (I) follows the use of $C^{14}H_3COONa$ (II) or $C^{14}H_3NH_2 \cdot HCl$ (III) as substrate. II enters the pyridine and pyrollidine rings, whereas III is only incorporated in the pyrollidine ring. I-content remains roughly constant due to both synthesis and breakdown. When the seeds mature there is not only incorporation of I from the vegetative organs but biosynthesis of I also takes place. (Translated from Chem. Zbit. 134,44-1:1963, 19289, MB)

604 Krampl, V. THE ROLE OF Δ^1-PYRROLINE-5-CARBOXYLIC ACID IN THE BIOSYNTHESIS OF THE PYRROLIDINE RING OF NICOTINE. Diss. Abstr. 22, 2 (1961) 418-9.

Ornithine-2-C^{14}, glutamic acid-2-C^{14}, proline-C^{14}, and putrescine-1,4-C^{14} have been found to be efficient precursors for biogenesis of the pyrrolidine ring of nicotine. The objective of the present study was to

investigate the participation of Δ^1-PC-5 in the biogenesis of nicotine. Dl-Δ^1-pyrroline-5-carboxylic acid-5-C^{14} was synthesized, isolated as a hydrochloride and fed hydroponically to intact 3 months old tobacco plants. Each plant received 1-2 mg of dl-Δ^1-PC·HCl-5-C^{14} ($2.0 - 4.0 \times 10^6$ cpm). The isolated nicotine was radioactive, specific activities ranging from 4.5 to 0.6×10^6 cpm/mM which corresponds to 0.14 - 0.02% incorporation of the precursor. - The feeding technique employed is described. After expiration of the feeding period (7 d), ~ 25% of the radioactivity originally fed to the plants was still recoverable, the main peak still corresponding to that of the original solution fed. The relatively high incorporation of radioactivity into the N-methyl group is the only significant difference from the labelling pattern obtained with other known precursors of the pyrrolidine ring of nicotine. Implications of results are discussed. Previous findings indicating roots of tobacco plants as the main site of nicotine biosynthesis and leaves as nicotine depots are supported.

605 Tso, T.C. NORNICOTINE AS A PRECURSOR OF NICOTINE IN Nicotiana PLANTS. Bot. Bull. Acad. sinica 4, 2 (1963) 75-79. (In Chinese, with English summary).

Tobacco plants (Nicotiana rustica L. var. brasilia) were placed in tritiated water. The biosynthesis of nicotine was traced via a precursor, nornicotine, by a mechanism involving alkaloid biosynthesis.

II-F-b CARBAMATES

606 Casida, J.E. MODE OF ACTION OF CARBAMATES. Annu. Rev. Ent. 8 (1963) 39-58.

Review. The various aspects considered by the author are general pharmacology, correlation of structure and activity, hydrolysis, in vitro and in vivo reaction with esterases, metabolism in mammals, plants, and insects. Studies using radioisotopes are cited, also some unpublished results obtained by H.W. Dorough, N.C. Leeling, J.G. Krishna and J.E. Casida in administering carbonyl-C^{14}-labelled Sevin (1-naphthyl methylcarbamate) to houseflies, rats, and bean and cotton plants.

607 Casida, J.E. RADIOTRACER APPROACHES TO CARBAMATE INSECTICIDE TOXICOLOGY. p.223-38 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Dimethylcarbamates have been prepared with carbonyl-C^{14}-labelling and methylcarbamates with methyl; carbonyl- and ring-labelling utilizing carbon-14. The pharmacological action of these compounds presumably results from acetylcholinesterase inhibition and may involve carbamylation. Reaction of carbonyl- or methyl-labelled carbamates with purified cholesterase or other esterases would allow a critical examination of this carbamylation reaction and the ease of spontaneous and the ease of spontaneous and induced reactivation or decarbamylation. The physiological significance of cholinesterase inhibition might be examined by administering acetate-C^{14} and analysis for radiolabelled acetylcholine accumulation in nervous tissue, or by utilizing acetyl-C^{14}-choline as the substrate for in vitro determination of the degree of cholinesterase inhibition in tissues of poisoned animals with minimal dilution of the inhibitors and enzymes during analysis. Some progress has been made with radiolabelled materials in investigating the metabolism of carbamate insecticides. Sevin (1-naphthyl methylcarbamate) has been most extensively studied along with its potential hydrolysis products. The assumption that the metabolism of Sevin involves an initial hydrolysis and then further decomposition of the fragments was not supported by carbon-14 studies. The major detoxification mechanism in mammals, and probably also in insects, results from initial oxidative attack on the carbamate by the microsomes in the presence of reduced nicotinamide-adenine dinucleotide phosphate. Sevin is rapidly metabolized in mammals, but the fate of certain of the fragments has not been resolved. Some of the metabolites appear in the milk of lactating animals. One step in the metabolism appears to be formation of the N-methylol derivative. Preliminary studies on the metabolism of radiolabelled Dimetilan (2-dimethyl-carbamyl-3-methylpyrazolyl-(5)-dimethylcarbamate) and a related compound in cockroaches also indicate that oxidative attack forms N-methyl N-methylol derivatives. (From auth.)

608 Casida, J.E. RADIOTRACER STUDIES ON THE MECHANISM OF INSECTICIDAL ACTION. (Abstr. K15230) p.162 in "Research and Development in Progress. Biology and Medicine. Issue No.1". TID-4200, Division of Technical Information, AEC. July 1963.

The metabolism of carbamate insecticides will be intensively investigated using C^{14}-labelled materials. Dimethylcarbamates labelled in the carbonyl grouping and N-methylcarbamates labelled in the carbonyl.

methyl and aromatic groups will be considered. Compounds to be examined will include the dimethylcarbamate, dimetilan, and the N-methylcarbamates of 1-naphthol, o-isopropoxyphenol, m-isopropylphenol, 4-methylthio-3,5-xylenol and 4-dimethylamino-3,5-xylenol. Characteristics of the compounds to be considered include residual persistence and fate in plants, metabolic pathway and rate of detoxication in mammals, enzymatic mechanisms of detoxication, resistance mechanisms and the mode of action of synergists.

609 Dorough, H.W., Casida, J.E. NON-HYDROLYTIC PATHWAY IN METABOLISM OF SEVIN. (Abstr. 62). Bull. ent. Soc. Amer. 9, 3 (1963) 163.

The metabolism of C^{14}-tagged Sevin by rat liver microsomes, insects, and plants was examined. At least 8 metabolites, 5 of which were carbamates, were formed by the microsomes and insects. Most of these metabolites were absent in plants. The nature of the products will be discussed.

610 Dorough, H.W., Leeling, N.C., Casida, J.E. NON-HYDROLYTIC PATHWAY IN METABOLISM OF N-METHYLCARBAMATE INSECTICIDE. Science 140 (1963) 170-1.

C^{14}-labelled Sevin was used. Sevin (1-naphthyl N-methylcarbamate), when metabolized by rat liver microsomes and insects (Musca domestica L. and Periplaneta americana (L.)) yielded at least 5 carbamate metabolites involving modifications of both the methyl group and ring. Certain of these metabolites appeared in milk when Sevin was fed to a goat. The metabolism of o-isopropoxyphenyl N-methylcarbamate by liver microsomes, insects and plants was compared to that of Sevin.

611 Eldefrawi, M.E., Hoskins, W.M. RELATION OF THE RATE OF PENETRATION AND METABOLISM TO THE TOXICITY OF SEVIN TO THREE INSECT SPECIES. J. econ. Ent. 54, 3 (1961) 401-5.

Sevin(R) (1-naphthyl N-methylcarbamate) labelled with C^{14} has been used on three insect species by topical application in acetone. Sevin is absorbed rapidly into house flies (Musca domestica L.), 75% of a dose penetrating within 4 h. It is rapidly metabolized and excreted, so final toxicity is low as shown by the LD_{50} = 2.0 $\mu g/♀$. Resistant house flies differ from susceptible ones only in greater metabolism and consequent lower mortality. If metabolism is prevented by addition of a synergist such as sesamex, the toxicity of Sevin is increased up to 50-fold, and much of the absorbed Sevin remains in the body unchanged. The critical step is the hydrolysis of Sevin to 1-naphthol and methyl amine, which is controlled by a carbamate esterase enzyme. When this is inhibited, e.g., by sesamex, the toxicity is high. Sevin penetrates more slowly into the large milkweed bug (Oncopeltus fasciatus (Dall.)), e.g., 40% of an applied dose enters in 8 hours. It is metabolized and excreted very slowly so that LD_{50} is low, i.e., 0.5 μg/insect. The German cockroach (Blattella germanica (L.)) absorbs Sevin slowly and metabolizes it rapidly. This results in low toxicity, LD_{50} = 20 $\mu g/♂$. The metabolic products are different in the three species and are formed by different reactions. (Auth.)

612 Krishna, J.G., Dorough, H.W., Casida, J.E. RADIOLABELED INSECTICIDES: SYNTHESIS OF N-METHYLCARBAMATES VIA METHYL ISOCYANATE-C^{14} AND CHROMATOGRAPHIC PURIFICATION. J. agric. Food Chem. 10, 6 (1962) 462-6.

The increasing interest in N-methylcarbamates as insecticides prompted their radiolabelling. A convenient radiosynthesis procedure is reported for Sevin (1-naphthyl-N-methylcarbamate), Hercules 5727 (Union Carbide 10854, the N-methylcarbamates of m-isopropylphenol), Bayer 39007 (o-isopropoxyphenol), Bayer 37344 (4-methylthio-3,5-xylenol), and Zectran (4-dimethylamino-3,5-xylenol). Acetyl-C^{14} chloride and sodium azide were reacted to yield methyl isocyanate-C^{14} which was then reacted with the appropriate phenol. A two-compartment reaction tube with a break-seal was utilized. Yields on a 0.5 mM scale were routinely 40 to 70%. Chromatographic procedures for isolating the N-methyl carbamates from their reaction mixtures are reported.

613 Leeling, N.C., Krishna, J.G. CONJUGATES OF CARBAMATE METABOLISM OF SEVIN. (Abstr. 61) Bull. ent. Soc. Amer. 9, 3 (1963) 163.

Administration of Sevin-C^{14} to rats resulted in excretion of about 2/3 of the dose in the urine as conjugates of hydroxylated metabolites with the carbamyl group intact. Enzymatic preparations of rat liver were used to examine the nature of these conjugation systems. Evidence for hydroxylated metabolites of Sevin was found.

II-F-c ARSENIC

614* Saito, K., Ikeda, S., Saito, M. THE SEPARATION OF RADIOACTIVE ARSENIC FROM GERMANIUM IRRADIATED WITH PROTONS. Bull. chem. Soc. Japan 33, 7 (1960) 884-7. (In English).

In order to obtain As^{74} of high purity and specific activity as a tracer or for other purposes, chemically pure (99.999999%) Ge and (99.999%) GeO_2 were irradiated in the INS cyclotron with protons from 10 to 14 MeV. The irradiated target contained $As^{76,71,72,73,74}$ and ^{76}, as well as Ge^{69} and ^{71}, and small amounts of $Ga^{67,68,70}$ and ^{72}. At a current density of 15 μA and a duration of 5 h, the total radioactivity was of the order of several-ten mc, and the amount of As^{74} appeared to be 1 mc or less. The irradiated target was dissolved in aqua regia (30 ml) and the GeO_4 formed was distilled until a residue of 1 ml remained. Then the As_2O_3 was distilled in the presence of 10 N HCl (10 ml) and 9 N HBr (5 ml) in an ice-cooled adapter containing H_2O. Although the As recovery was 94%, very little radioactive As was obtained. The distillate was taken up with H_2SO_4, reduced with KI and Na_2SO_3, and extracted with CCl_4 and diethyldithiocarbamate. All operations were followed with a G-M counter. For measuring the conversion electron spectrum, the As was extracted with HNO_3, mounted on a trace of insulin on a thin polyvinyl chloride foil lined with a thin layer of vacuum-evaporated Al, dried in vacuo, and measured by β-spectroscopy. (TID-6613, suppl.1)

II-F-d SULFUR

615 Otto, H.L., Winand, M. THE PREPARATION OF CURIE QUANTITIES OF S^{35}-LABELED ELEMENT SULFUR. Int. J. appl. Rad. Isotopes 10, 2/3 (1961) 130-1.

In many preparations of S^{35}-labelled compounds elemental S is the starting material. Usually S^{35} is obtained by irradiating KCl in a reactor which, according to $Cl^{35}(n,p)S^{35}$, gives radiosulfur. The radioisotope is isolated as $H_2S^{35}O_4$ which contains an excess of HCl. A method and an apparatus are described by which a sulfate solution of elemental S of high specific activity can be obtained. (TID-3098, 522)

616 Соколов, В.А., Тихомирова, Е.А., Косолапова, Н.А. РАДИОАКТИВНЫЙ ИЗОТОП СЕРЫ S^{35}. М., Атомиздат. 1960. 25 стр.

Sokolov, V.A., Tikhomirova, E.A., Kosolapova, N.A. THE RADIOSULFUR ISOTOPE, S^{35}. Moscow, Atomisdat. 1960. 25p.

Sections are included on (1) physical properties and methods of obtaining S^{35}; (2) production of preparations containing S^{35}; (3) uses of S^{35}; and (4) safety techniques to be used when working with S^{35}.

* * *

See also:

303 Radiometric assay of acetylcholinesterase. (Winteringham and Disney, 1962)
304 Acetylcholinesterase activity and competitive inhibition at low substrate concentrations. (Winteringham and Disney, 1963)

II-G Insecticide Metabolism in

II-G-1 INSECTS

II-G-1-a GENERAL

617 Agosin, M. PRESENT STATUS OF BIOCHEMICAL RESEARCH ON THE INSECTICIDE RESISTANCE PROBLEM. Bull. World Hlth Org., Suppl. 29 (1963) 69-76.

Review article. Enzymatic detoxication reactions considered are conjugation, oxidation, reduction, dehydrochlorination, and detoxication of heavy metal poisons by reaction with S compounds. Resistance mechanisms to DDT, BHC, Prolan, cyclodiene insecticides, pyrethrins and organophosphurs insecticides are discussed, and a number of studies quoted in which radioisotopes were used.

618 Hopkins, T.L. RADIOISOTOPE TECHNIQUES AND RECENT RESEARCH ON METABOLISM OF INSECTICIDES IN INSECTS. p.101-9 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

Techniques useful for investigations of radioisotope-labelled insecticides and insects and their application to the study of insect mechanisms of resistance are reviewed. Data are presented on the quantitative fate and metabolism of P^{32}-labelled Dipterex, O,O-dimethyl 1-hydroxy-2,2,2-trichloroethyl phosphonate, in normal and Dipterex-resistant houseflies. The resistant fly strain was able to detoxify the insecticide and excrete the water soluble metabolites at a more rapid rate than the normal flies. Metabolites were identified by paper chromatography, and no qualitative differences were found between strains. (From auth.)

II-G-1-b BIDRIN

619 Bull, D.L., Lindquist, D.A. METABOLISM OF RADIO-LABELED SD-3562 IN INSECTS AND COTTON LEAVES. (Abstr. 41). Bull. ent. Soc. Amer. 8, 3 (1962) 154.

The absorption and in vivo metabolism of C^{14} or P^{32} labelled 3-(dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide (SD-3562) by bollworms (Heliothis zea (Boddie)), boll weevils (Anthonomus grandis Boheman), and excised cotton leaves were studied through the use of standard radiometric techniques.

II-G-1-c CYCLODIENE

626 Brooks, G.T., Harrison, A. METABOLISM AND TOXICITY OF THE "CYCLODIENE" INSECTICIDES. Biochem. J. 87, 1 (1963) 5P-6P.

The relatively low toxicities to the adult housefly, Musca domestica L., of the compounds chlordene (I; heptachlor precursor); 1,2,3,4,9,9-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-methanonaphthalene (II) and its 6,7-double bond isomer (III) are in the order I > II > III. Studies by gas chromatography and with C^{14}-labelled compounds have shown that this is also the order of epoxide formation in vivo; chlordene forms an appreciable amount of a tentatively identified epoxide; (II) gives a small amount of a similar substance; (III) does not apparently give an epoxide. All 3 compounds are further converted into more polar substances.

II-G-1-d ALDRIN AND DIELDRIN

621 Cohen, A.J., Smith, J.N. FATE OF ALDRIN AND DIELDRIN IN LOCUSTS. Nature, Lond. 189, 4764 (1961) 600-1.

The metabolism and excretion of aldrin and dieldrin in Schistocerca gregaria (Forsk.) were examined quantitatively by means of preparations labelled with Cl^{36}. Solutions contained 2 µg labelled aldrin or dieldrin in 5 µl olive oil (representing about 100 cpm) were injected into the abdomens of 5th instar hoppers. They were subsequently kept at room temperature for 7 d. Any that died during this period and survivors (plus excreta) were preserved under ethanol. This procedure was repeated until enough radioactive solution to provide 40 000 cpm had been injected. The preserved material was homogenised with ethanol and repeatedly extracted with acetone, NH_4OH and HCl in turn until radioactive material representing 40 000 cpm had been recovered. Aldrin and dieldrin were re-isolated from the concentrated extracts. It was found that both materials were excreted slowly, the rate at which aldrin was oxidized to dieldrin being slower than that recorded for Musca domestica L. (Nature 186 (1960) 96). Dieldrin was excreted unchanged and repeated sublethal doses should therefore exert a cumulative action in locusts.

II-G-1-e DDT

622 Abedi, Z.H., Duffy, J.R., Brown, A.W.A. DEHYDROCHLORINATION AND DDT-RESISTANCE IN Aedes aegypti. J. econ. Ent. 56, 4 (1963) 511-7.

Larvae of 6 DDT-resistant and 5 susceptible strains of the yellow-fever mosquito, Aëdes aegypti (L.), were all susceptible to Dilan® (a mixture of 1 part of 1,1-bis(p-chlorophenyl)-2-nitropropane (Prolan) and 2 parts of 1,1-bis(p-chlorophenyl)-2-nitrobutane (Bulan), but the former were resistant to o-chloro-DDT

and usually to iso-o-chloro-DDT. DMC was synergistic with DDT, o-chloro-DDT, and iso-o-chloro-DDT for the resistant strains. Paper chromatography revealed DDE as the only metabolite of DDT, other candidate metabolites and water-soluble derivatives being absent; o-chloro-DDE was detected as the only metabolite of o-chloro-DDT. The resistant strains produced more DDE and o-chloro-DDE than the susceptible strains, and this production was apparently reduced by DMC. The following radioactive compounds were used: C^{14}-DDT. a) ring-labelled on the para-carbons (activity 3.22 mc/g) b) chain-labelled on the 1-carbon, i.e. 1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane-1-C^{14}, synthesized by J.R.D. (activity 1.75 mc/g) C^{14}-DDE. Made from ring-labelled DDT by refluxing it with 2% KOH in 95% aqueous ethanol for 1 h. o-Chloro-DDT. a) chain-labelled on the 1-carbon (activity 1.52 mc/g) b) chain-labelled on the 2-carbon (activity 1.35 mc/g), both synthesized by J.R.D. o-Chloro-DDE. Made from the 1-carbon-labelled o-Cl-DDT by refluxing it with 2% KOH in 95% aqueous ethanol for 30 min.

623 Bull, D.L., Adkisson, P.L. ABSORPTION AND METABOLISM OF C^{14}-LABELED DDT BY DDT-SUSCEPTIBLE AND DDT-RESISTANT PINK BOLLWORM ADULTS. J. econ. Ent. 56, 5 (1963) 641-3.

A Torreon, Mexico strain of Pectinophora gossypiella (Saunders) adults was found to be 6 times more resistant to DDT at the LD_{50} level and 13 times more resistant at the LD_{90} level than moths from El Paso, Texas. The radioactive (C^{14}-ring-labelled p,p'-DDT had a specific activity of 1850 cpm/μg. Adults were treated topically, with from 0.5 to 3.0 μg of DDT. During the first 24 h after treatment, absorption of DDT was slightly more rapid by moths of the El Paso strain. Dehydrochlorination of absorbed DDT to DDE occurred in adults from both strains, but the detoxification was much more extensive in individuals from the Mexican strain.

624 Cuckomp, L.K., Wattal, B.L. DENSITY-MORTALITY RELATIONS IN MOSQUITO BIOASSAY. (Abstr. 94). Bull. ent. Soc. Amer. 9, 3 (1963) 165.

When DDT is tested against Aëdes aegypti larvae the mortality declines with greater densities. Determinations of amounts of DDT picked up indicate that less DDT is picked up per larvae when the density is great. C^{14}-labelled DDT has been used for the determination.

625 Dinamarca, M.L., Agosin, M., Neghme, A. THE METABOLIC FATE OF DDT-C^{14} IN Triatoma infestans. Exp. Parasitol. 12 (1962) 61-72.

Rates of absorption of DDT by nymphs and adults were determined following application of DDT-C^{14} in acetone solution to the ventral abdominal regions of the insects. Absorption in nymphs increased to a maximum of approximately 60% of the amount applied after 72 h and remained constant at this level for at least 480 h. Over 37% of the absorbed DDT was either excreted or metabolized in nymphs. Absorption in adults increased almost linearly from 27% of the amount applied at 72 h to 120 h at which time all adults were dead. Only 9% of the absorbed DDT was metabolized or excreted by adults. Metabolites of DDT were detected by measurement of radioactivities from paper chromatograms of extracts of the insects or their faeces. 5 metabolites, of which 4 were unidentified and 1 was identified as 2,2-bis(p-chlorophenyl)-1, 1-dichloroethylene (I), were detected, but different in quality, composition, and quantity in internal extracts and in faecal extracts of nymphs and adults, and with time. I was the most important metabolite quantity in nymphs; almost 21% of the absorbed radioactivity was found as I in the 1st 24 h. After 48 h, the rate of I production in nymphs decreased. Of the metabolites produced by adults, only 1 unidentified compound was accumulated to a significant extent. Higher resistance of nymphs toward DDT was attributed, at least in part, to differences in absorption and detoxication processes. Pathways for the independent production of I and the unidentified metabolites, linked through participation of reduced triphosphopyridine nucleotide, were proposed. (CA 57: 1962, 10372i)

626 Gast, R.T. FACTORS INVOLVED IN DIFFERENTIAL SUSCEPTIBILITY OF CORN EARWORM LARVAE TO DDT. J. econ. Ent. 54, 6 (1961) 1203-6.

Full-grown corn earworms, Heliothis zea (Boddie), require more than 1000 times as much DDT on a weight basis as small larvae in order to obtain LD_{50} values for topical applications in acetone. Injected DDT in acetone is only slightly less effective on large larvae than on small ones. The non-radioactive DDT was chiefly the p'-isomer obtained by 3 recrystallizations of technical material from hot ethanol (melting point was 106.5°C). Radioactive DDT was synthesized with Cl^{36} in the p-p' position (melting point 106.3°C after recrystallization). When assayed on internal flow proportional counter the DDT gave 25 cpm/μg. Chemical and radiometric analysis showed that lack of penetration by DDT through the integument of the

large larvae was the chief factor causing the increase in LD_{99} values. Addition of nonvolatile oils to the topically applied material increases the effectiveness of DDT to the larger larvae. Tests with different colored larvae indicate that light yellow larvae are approximately twice as susceptible as the dark red or black larvae.

627* Hoskins, W.M., Erwin, W.R., Andrews, T. METABOLISM OF DICHLORODIPHENYLTRICHLOROETHANE IN THE GERMAN ROACH. p.1307-9 in "Proceedings of the 4th International Congress of Crop Protection, Hamburg, September 1957. Section 13. Insecticides. Vol.II". Brunswick, 1960.

The metabolism of DDT in Blattella (Blatta) germanica (L.) was investigated by means of topical application of a sample of C^{14}-labelled DDT. This technique, combined with chromatography of extracts and excreta led to the finding of 4 metabolites, all more polar in nature than DDT but differing from DDE (ethylene, 1,1-dichloro-2,2-bis(p-chlorophenyl)-.)

628 Lindquist, D.A., Brazzel, J.R., Davich, T.B. FATE OF DDT AND TOXAPHENE APPLIED TOPICALLY TO SUSCEPTIBLE AND RESISTANT BOLL WEEVILS. J. econ. Ent. 54 (1961) 299-300.

The metabolism of DDT by susceptible and resistant boll weevils (Anthonomus grandis Boh.) treated topically with DDT or DDT plus toxaphene was studied. Little difference was found between strains receiving the same treatments. Extracts of weevils treated with DDT plus toxaphene contained slightly more DDT than those of weevils treated with DDT alone. Poor recovery of the applied DDT was obtained. Tests with C^{14}-labelled DDT indicated that the treated weevils rubbed off much of the toxicant and converted a small quantity to a compound which did not respond to the colorimetric analysis employed. Resistant weevils treated with toxaphene absorbed less than similarly treated susceptible weevils. (Auth.)

629 Perry, A.S., Miller, S., Buckner, A.J. THE ENZYMATIC IN VITRO DEGRADATION OF DDT BY SUSCEPTIBLE AND DDT-RESISTANT BODY LICE. J. agric. Food Chem. 11, 6 (1963) 457-62.

Homogenates and acetone powders of both susceptible and DDT-resistant body lice (Pediculus humanus humanus L.) catalyze the degradation of DDT in vitro. Reduced glutathione, cysteine, ascorbic acid, thioglycollic acid, and coenzyme A may be used as cofactors for activation of the enzyme system. Enzyme preparations when incubated with DDT under optimum conditions yield at least 3 metabolites. On the basis of their neutral or acidic character, ultraviolet and infrared absorption spectra, colorimetric analysis, and paper chromatography, the metabolites have been identified as 2,2-bis-(p-chlorophenyl)-1,1-dichloroethylene (DDE); 4,4-dichlorobenzophenone (DBP); and bis-(p-chlorophenyl)acetic acid (DDA). This is the first demonstration of DDA as a product of DDT metabolism in an insect. C^{14}-labelled DDT was used. (Mostly auth.)

II-G-1-f DFP

630* Iyatomi, K., Saito, T., Kanehisa, L., Nishizawa, T., Naruse, H. DISTRIBUTION AND METABOLISM OF P^{32}-LABELED DIISOPROPYL PHOSPHOROFLUORIDATE IN THE AMERICAN COCKROACH, Periplaneta americana. Botyu-Kagaku 22 (1957) 192-6.

The distribution and metabolism of diisopropyl phosphorofluoridate (I) in the American cockroach topically treated with P^{32}-labelled I were studied. Very small amounts of I were found in the central nervous system, and comparatively large amounts were found in the digestive system and Malpighian tubes. Alcohol-formic acid fractionation revealed that about 10% of the total I taken up by the tissues were acid-soluble phosphorylated compounds and others were not incorporated into the acid-soluble compounds. It may be assumed that only 1/10 of the I in the insect tissues actually inhibits cholinesterases and other enzymes. Metabolites of I were observed in the digestive systems and coxal muscles. After topically applied I has penetrated into the body of the cockroach, it may be transported to the tissues by the blood. (From BA 35: 1960, 9633).

II-G-1-g DIAZINON

631 Forgash, A.J., Cook, B.J., Riley, R.C. MECHANISMS OF RESISTANCE IN DIAZINON-SELECTED MULTI-RESISTANT Musca domestica. J. econ. Ent. 55, 4 (1962) 544-51.

Studies were made in 3 strains (a susceptible, a low-resistant, and a high-resistant) of house flies (Musca domestica L.) to determine whether resistance to diazinon(R) (O,O-diethyl O-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate), parathion and DDT is attributable to differences in absorption rates. P^{32}-labelled diazinon was used. Processing of samples for P^{32}-counting (extraction, concentration of extracts and counting itself) are described. Penetration studies with diazinon showed less rapid absorption by resistant flies and it was concluded that reduction in permeability of the cuticle is a factor in resistance to diazinon. This is not the only defense mechanism, however, since flies which were 125-fold resistant by topical measurement still showed some tolerance (14-fold) when the insecticide was injected. Similarly, the low-resistant strain (15-fold topically) was 3-fold resistant to injected diazinon. More rapid detoxication is precluded as the additional resistance mechanism, since the susceptibles contained higher amounts of water-soluble metabolites than resistant flies. Resistance to diazinon was higher by oral application than by either injection or topical treatment. Ali-esterase activity of the strains was inversely proportional to the level of diazinon resistance; this fact confirms previous reports on other o-p resistant house flies. There were only slight differences among the strains in cholinesterase level and in sensitivity to in vitro inhibition. In parathion and DDT-resistance, penetration appears not to be an important factor.

II-G-1-h DIMETHOATE

632 Bull, D.L., Lindquist, D.A., Hacskaylo, J. ABSORPTION AND METABOLISM OF DIMETHOATE(*) IN THE BOLLWORM AND BOLL WEEVIL. J. econ. Ent. 56, 2 (1963) 129-34.

P^{32}-labelled dimethoate (*) was absorbed and excreted rapidly by 5th instar bollworm larvae (Heliothis zea (Boddie)) and adult boll weevils (Anthonomus grandis Boheman). These insects absorbed 54.2% and 74.5% of topically applied dimethoate, respectively, after 24 h and 76.2% of an injected dose of dimethoate was excreted by bollworm larvae after 24 h. The in vivo metabolism of P^{32}-labelled dimethoate in adult boll weevils, 5th-instar bollworm larvae, and cotton seedlings was characterized qualitatively and quantitatively through the use of paper chromatography, autoradiography, and standard radioassay procedures. Dimethoate and 11 metabolites were detected in various insect and plant extracts. In bollworms, the principal sites for hydrolytic cleavage of the dimethoate molecule were the carbonyl-nitrogen bond and the sulfur-carbon bond. The oxygen analogue of dimethoate was formed in both plants and insects but was broken down rapidly by the latter to non-toxic products. (Auth.)

* O,O-dimethyl S-(N-methylcarbamoylmethyl)phosphorodithioate.

II-G-1-j IMIDAN

633 Menn, J.J., McBain, J.B. METABOLISM OF IMIDAN IN INSECTS. (Abstr. 50). Bull. ent. Soc. Amer. 9, 3 (1963) 163.

The metabolic fate of C^{14}-Imidan [phthalimidomethyl-O,O-dimethyl-phosphorodithioate] was studied in insects in vivo. Purified acetone extracts of whole insect homogenates were examined by means of paper chromatographic and radiotracer techniques. Results were correlated with the metabolic fate of Imidan in plants.

II-G-1-k IRIDOMYRMECIN

634 Korte, F., Schreiber, H.J. INSEKTIZIDE IM STOFFWECHSEL. IV. IRIDOMYRMECIN-(3-^{14}C). (Insecticides in metabolism. IV. Iridomyrmecin-(3-C^{14})). Liebigs Ann. 656 (1962) 145-8. (In German).

A method for microsynthesizing C^{14}-labelled iridomyrmecin is described, starting with $BaC^{14}O_3$ (specific activity 23.5 mc/mM). The insecticide is broken down into the corresponding δ-hydroxy-carboxylic acids by freshly ground beef liver and Aëdes aegypti larvae (5-d-old larvae were left for 20 h, such that 20 cc water were and 200 γ-iridomyrmecin were allowed per 5 g larvae). Of the enzymes testes (catalase, peroxidase, glucose oxidase, α-chymotrypsin, and a mixture of hydrolases from Aspergillus oryzae) none appeared to have any effect on the insecticide.

II-G-1-l NAPHTHALENE

635 Arias, R.O. THE IN VIVO HYDROXYLATION OF NAPHTHALENE-1-C^{14} BY HOUSEFLY MICROSOMES. Diss. Abstr. 24, 5 (1963) 1817-8.

Naphthalene-1-C^{14} was utilized for establishing the optimum conditions for the hydroxylation of aromatic hydrocarbons by microsomes isolated from Musca domestica L. Reduced triphosphopyridine appears to be essential for the hydroxylation reactions. A transitory metabolite, possibly an epoxide of naphthalene, does not require TPN. The increasing order of naphthalene metabolism by microsomes isolated from 6-d-old flies was, according to strain: susceptible, dieldrin-resistant, naphthalene-resistant, and DDT resistant. These differences were found to be insignificant among the first 3 strains when the microsomes were isolated from 12-d-old flies. Chromatographic evidence was presented with shows that the 4 strains produced the same 5 naphthalene metabolites when 6-d old, but only the susceptible strains exhibited this pattern when the flies were 12-d old. The oxidative mechanism of the microsomal system was inhibited by SKF 525-A and piperonyl butoxide. The soluble fraction has been shown to possess the necessary mechanism for the hydroxylation of naphthalene, however, the amount of substrate metabolized was less than with microsomal fractions. Chromatographic evidence indicated that 7 non-volatile metabolites were produced when naphthalene was the substrate and only 5 when 1-naphthol-1-C^{14} was used.

II-G-1-m MALATHION

636 Bigley, W.S., Plapp, F.W., Jr. METABOLISM OF MALATHION AND MALAOXEN BY THE MOSQUITO, Culex tarsalis Coq. J. Insect Physiol. 8, 9/10 (1962) 545-57.

Radiometric and enzymatic techniques were used in studying the metabolism of malathion and malaoxon by susceptible and malathion-resistant Culex tarsalis Coq. larvae. Radiometric studies showed malathion-resistant larvae were 2 to 11 times more efficient in degrading malathion than susceptible larvae, both in vivo and in vitro. Malathion was degraded primarily by the formation of carboxylic acid derivatives in larvae of both colonies. In vitro studies showed resistant larval homogenates produced over 11 times more carboxyesterase derivatives than phosphatase derivatives as compared with a 2:1 ratio in susceptible larvae. Enzymatic studies indicated that the relatively small fraction of total malathion converted to malaoxon was detoxified at a much more rapid rate in larvae of the resistant than in larvae of a susceptible strain. The differences noted are of sufficient magnitude to be considered primary factors responsible for the resistance to malathion present. (Auth.)

637 Bigley, W.S., Plapp, F.W., Jr. METABOLISM OF MALATHION IN SUSCEPTIBLE AND RESISTANT HOUSE FLIES. (Abstr.246). Bull ent. Soc. Amer. 9, 3 (1963) 172.

Degradation of C^{14} malathion was rapid in both susceptible and malathion-resistant housefly strains. The resistant strain degraded the compound at a rate several times greater than did susceptible flies. The malathion synergist DEF greatly decreased the rate of malathion degradation.

638* Matsumura, F. THE PERMEABILITY OF INSECT CUTICLE. M.S. Thesis, University of Alberta, Canada 1959.

639 Matsumura, F., Brown, A.W.A. BIOCHEMISTRY OF MALATHION RESISTANCE IN Culex tarsalis. J. econ. Ent. 54, 6 (1961) 1176-85.

Radioactive malathion was synthesized from P^{32}-phosphoric acid (see J. econ. Ent. 52 (1961) 1063) and purified. Larvae of the resistant strain of Culex tarsalis Coquillett, on exposure to malathion, come to contain ½ as much malaoxon as normal larvae. This is partly due to a higher phosphatase activity hydrolyzing malaoxon. But the major difference is in the higher carboxyesterase activity hydrolyzing malathion; this interstrain difference was demonstrated in vivo in larvae cleared of gut contents, and in vitro in homogenates and particularly the mitochondrial fraction. EPN, a carboxyesterase inhibitor, proved synergistic for malathion against the resistant strain. Increased carboxyesterase content was inseparable genetically from malathion resistance in hybridization experiments, which also indicated the malathion resistance to be due to a single partially dominant gene allele.

640 Matsumura, F., Brown, A.W.A. BIOCHEMICAL STUDY OF A MALATHION-TOLERANT STRAIN OF Aedes aegypti. Mosquito News 21 (1961) 192-4.

Larvae of a malathion-tolerant strain Aëdes aegypti did not differ from the normal in the activity of phosphatase, carboxyesterase, or aliesterase. Experiments with P^{32}-labelled malathion showed 1/12 as much absorption and retention of malathion as in larvae of the normal strain. The high cross-resistance shown by this strain to DDT was accompanied by only 1/4 as much absorption and retention of DDT as normal. C^{14}-labelled DDT was used (1 ppm).

641 Mengle, D.C., Lewallen, L.L. HISTOCHEMISTRY OF MALATHION RESISTANCE IN THE ENCEPHALITIS MOSQUITO, Culex tarsalis Coq. (Abstr.55). Bull. ent. Soc. Amer. 8, 3 (1962) 155.

Using histochemical and radioautographic techniques the metabolism and mode of action of malathion was investigated in resistant and susceptible strains of the mosquito, Culex tarsalis Coq. Relationships between the results of these experiments and levels of resistance will be discussed. (Auth.)

642 Mengle, D.C., Lewallen, L.L. METABOLISM OF MALATHION BY A RESISTANT AND A SUSCEPTIBLE STRAIN OF Culex tarsalis: I. DEGRADATION IN VIVO AND IDENTIFICATION OF ORGANIC SOLUBLE METABOLITES. Mosquito News 23, 3 (1963) 226-33.

Larvae of a resistant and a susceptible strain were treated with a discriminating dose of P^{32}-labelled malathion. The larvae were homogenized at various times, up to 24 h, extracted, and the insecticide metabolites identified qualitatively and quantitatively by column and paper chromatography. At the time the water-soluble metabolites were considered as a single group; the chloroform-soluble constituents were further identified as the original malathion and its toxic oxidation product, malaoxon. A similar rate of penetration of malathion into both strains is implied, with similar rates of conversion of malathion to malaoxon, and similar degradation of malathion. Hydrolysis of malaoxon however, occurred at twice the rate in the resistant strain as in the susceptible strain. Malaoxon concentrations were found to be not similar in the 2 strains at the time of similar symptoms (LT_{50}). Homogenizing the larvae may have masked the concentration at a vital locus.

II-G-1-n PARATHION AND METHYL PARATHION

643 Fukami, J., Shishido, T. SELECTIVE TOXICITIES OF ORGANIC PHOSPHORUS INSECTICIDES. III. AN ENZYME SYSTEM INCLUDED IN THE CLEAVAGE OF METHYL PARATHION TO DEMETHYL PARATHION IN THE SUPERNATANT OF SOME TYPES OF HOMOGENATES. Botyu-Kagaku 28, 3 (1963) 77-81.

The nature of the reaction system from methyl parathion to demethyl parathion was studied in tissues of mammals (rat, guinea pig, and rabbit) and insects (Chilo suppressalis, Periplaneta americana, and Xylotrupes dichotomus), using P^{32}-labelled methyl parathion and Me paraoxon. The reaction in the supernatant from rat-liver homogenate was independent of the presence of coenzyme II and was inhibited most effectively by phenylmercury acetate and p-chloromercuribenzoate. The optimal pH was 8.5-9.5. Addition of reduced glutathione restored the activity. Anaerobic conditions did not affect the reaction. These results suggested that the reaction requires the presence of a SH-containing enzyme. The highest activity was found in the liver among the organs tested, whatever the species. There was no activity in the blood of larvae of C. suppressalis or X. dichotomus. (CA 60: 1964, 15078cd)

644 O'Brien, R.D., Smith, E.H. THE UPTAKE AND METABOLISM OF PARATHION BY INSECT EGGS. J. econ. Ent. 54, 1 (1961) 187-91.

In an attempt to account for their widely differing susceptibilities to parathion, the uptake and metabolism of P^{32}-parathion vapor by eggs of the large milkweed bug (Oncopeltus fasciatus (Dall.)) and peach tree borer (Sanninoidea exitiosa (Say)) and the uptake by eggs of the Mexican bean beetle (Epilachna varivestis Muls.) and southern armyworm (Prodenia eridania (Cram.)) were investigated. In all cases large amounts of parathion were taken up by the chorion and most (50% to 94%) could be washed off with acetone followed by chloroform. Considerable variations were found in ability of the eggs to take up parathion and in penetration of the chorion by the parathion. In the ovicidally susceptible peach tree borer and the non-susceptible milkweed bug conversion of internal parathion to paraoxon was 30% and 25%, respectively, suggesting that activation and detoxification did not account for the insensitivity of the milkweed bug. In the other three species there was within broad limits a general relationship between internal levels of parathion and ovicidal susceptibility. No single factor could be cited to account for the variations in ovicidal susceptibility of the various species to parathion. (Auth.)

645 Plapp, F.W., Jr., Darrow, D.L., Bigley, W.S., Eddy, G.W. STUDIES ON PARATHION METABOLISM IN NORMAL AND PARATHION-RESISTANT HOUSE FLIES. J. econ. Ent. 54, 2 (1961) 389-92.

The absorption, detoxication, and excretion of (P^{32}-labelled) parathion and para-oxon were studied in susceptible and parathion-resistant strains of Musca domestica L. by radiometric techniques. No differences in the rate of absorption of the toxicants were noted between susceptible and resistant flies. Both insecticides were rapidly detoxified by the flies in vivo, the metabolism being more rapid in the resistant strain. Differences in the rate of excretion of parathion and/or its metabolites were not great, but para-oxon and/or its metabolites were excreted much more rapidly by flies of the resistant strain. (From auth.)

646 Schmidt, C.H., Weidhaas, D.E. THE TOXICOLOGICAL ACTION OF THREE ORGANOPHOSPHORUS INSECTICIDES WITH THREE SPECIES OF MOSQUITO LARVAE. J. econ. Ent. 54, 3 (1961) 583-6.

Toxicological studies were undertaken with radioactive-labelled parathion, Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate), and dimethoate to determine the dosage of these toxicants absorbed by larvae of Anopheles quadrimaculatus Say, Aedes aegypti (L.), Aedes taeniorhynchus (Wied.) The interrelationship of the dosage absorbed, the concentration, the time of exposure, and the mortality were also determined. Results indicated that the efficiency of uptake differed with the insecticide used. The concentration required to kill larvae did not necessarily reflect the amount of insecticide that entered the insect. For example, dimethoate in 24-h exposure tests gave an LC_{50} of 4.0 ppm and an LD_{60} of 0.0040 µg/larva; whereas Bayer 22408 gave an LC_{50} of 0.009 ppm and an LD_{50} of 0.0020 µg/larva. The amount of insecticide found in larvae after 24 h of exposure at the LC_{50} concentration was only a very small percentage of the total to which they were exposed; with dimethoate, 0.02%; with parathion, 0.7%; and with Bayer 22408, 2.2%. Better methods of treatment could make some inferior toxicants into effective larvicides and should increase the efficiency of all toxicants. All three insecticides were excreted readily by larvae. (Auth.)

II-G-1-o R 6700

647* Becker, H., Müller, P., Forster, H. ABSCHLUSSBERICHT ÜBER EINE UNTERSUCHUNG ZUR AUFKLÄRUNG DES INSEKTENSTOFFWECHSELS EINES ZUM PATENT ANGEMELDETEN INSEKTIZIDS (R 6700) DURCH MARKIERUNG MIT RADIOAKTIVEN ISOTOPEN FÜR DIE FIRMA RUHRCHEMIE AG., OBERHAUSEN-HOLTEN. (Final report on an investigation into the metabolism of insecticide R 6700, patent applied for, carried out for the firm Ruhrchemie AG., Oberhausen-Holten, by means of radioisotopes). Battelle Institut e.V., Frankfurt am Main, 9 May 1956, 16p. (In German).

Neutron-irradiated chloroform was mixed with 400 cc of 1% NH_4OH, and the Cl^{38} ions resulting from the irradiation separated out. A carrier substance in the form of NaCl was added, and on acidifying with HNO_3 it was possible to precipitate Cl^{38} together with the excess of $AgNO_3$ solution as $AgCl^{38}$. Contamination with radioactive phosphorus was avoided. Further steps in the synthesis of Cl^{38}-labelled R 6700 are described, together with the apparatus used. Shortage of time did not permit any precise determination of yield. Fly assays were carried out with Cl^{38}-R 6700 dissolved in CCl_4, subsequently evaporated. Flies were not given any water or sugar for 2 h before the test, and were exposed to the insecticide for 40 min. Only 20% (3-4/20) flies were dead, the others were anaesthetized with CO_2 and analyzed. The technique is given. Discrepancies in distribution data (for head, legs, thorax, wings, and remainder) point to weaknesses in the procedure. The desirability of a series of tests with C^{14}-R 6700 is stressed, which would allow larger numbers of flies to be tested and also permit better differentiation between absorbed and externally adsorbed or contaminating material.

II-G-1-p RONNEL

648 Hopkins, T.L. FUNCTIONS OF THE MADEIRA COCKROACH (Leucophaea maderae) ALIMENTARY TRACT IN THE ABSORPTION, METABOLISM, AND EXCRETION OF RONNEL. J. econ. Ent. 54, 2 (1961) 224-30.

The role of the alimentary tract of the Madeira cockroach, Leucophaea maderae (F.), in the in vivo processes of absorption, transport, metabolism, and excretion of P^{32}-labelled (O,O-dimethyl O-(2,4,5-trichlorophenyl) phosphorothioate) was investigated together with the qualitative and quantitative nature of the phosphorus-containing metabolites eliminated. The wall of the foregut was found to be permeable to orally injected ronnel but not to certain of its water soluble hydrolysis products while the hindgut was

permeable to both. The midgut primarily accumulated the water soluble metabolites when direct movement of ronnel from the foregut was blocked, and evidence suggests it as a site for hydrolytic degradation of the insecticide. More than 97% of the radioactivity accumulating in the hindgut was in the form of water-soluble degradation products with about 2/3 entering with the discharge of the malpighian tubules. Only small quantities of radioactivity passed directly from the mid- to the hindgut. Sublethal doses of ronnel progressively inhibited elimination of excreta while the hydrolysis products had little effect. The major metabolite of ronnel eliminated in the faeces was identified as dimethyl thiophosphate. This compound gradually diminished with time while the minor metabolites dimethyl phosphate and monomethyl ronnel increased. (Auth.)

II-G-1-q RUELENE

649 Brady, U.E., Jr., Arthur, B.W. ABSORPTION AND METABOLISM OF RUELENE BY ARTHROPODS. J. econ. Ent. 55, 6 (1962) 883-6.

The absorption and metabolism of P^{32}-labeled Ruelene® (O-4-tert-butyl-2-chlorophenyl O-methyl methylphosphoramidate) was studied in 16 species of arthropods. The house fly, Musca domestica L.; stable fly, Stomoxys calcitrans (L.); yellow mealworm, Tenebrio molitor L.; and American cockroach, Periplaneta americana (L.), absorbed greater than 80% of the topically applied dose by 24 h after treatment, whereas the boll weevil, Anthonomus grandis Boheman; Gulf Coast tick, Amblyomma maculatum Koch; and brown dog tick, Rhipicephalus sanguineus (Latreille), absorbed less than 25% of the applied dose. The following insects were also tested: horn fly, Haematobia irritans (L.), German cockroach, Blattella germanica (L.), imported cabbageworm, Pieris rapae (L.), larva; cabbage webworm, Hellula rogatalis (Hulst), larva; tobacco budworm, Heliothis virescens (F.), larva; corn earworm, Heliothis zea (Boddie), larva; rice weevil, Sitophilus oryzae (L.), adult; cadelle, Tenebroides mauritanicus (L.) Mexican bean beetle, Epilachna varivestis Mulsant, adult; bed bug, Cimex lectularius L., adult; cotton stainer, Dysdercus suturellus (Herrich-Schäffer), adult; and honey bee, Apis mellifera L. In general, adult Diptera degraded Ruelene more completely than Lepidoptera larvae, adult Coleoptera, or adult Hemiptera. Most of the radioactivity in the acetone extract of insects had the same R_f as Ruelene. The metabolism of Ruelene by insects and ticks was less complex than in mammals. Selectivity was probably a function of absorption and detoxification rates in naturally tolerant and in susceptible arthropod species.

II-G-1-r SCHRADAN

650* Saito, T. DISTRIBUTION OF P^{32}-LABELLED SCHRADAN IN THE AMERICAN COCKROACH [Periplaneta americana (L.)]. Botyu-Kagaku 25, 2 (1960) 57-64. (In Japanese, with English summary).

651* Saito, T. DISTRIBUTION OF P^{32}-LABELLED SCHRADAN IN VARIOUS INSECTS [Periplaneta americana (L.), Musca domestica L., Chilo suppressalis (Wlk.), Nephotettix cincticeps (Uhl.), Scotinophara lurida (Burm.) AND Leptocorisa varicornis (F.)]. Botyu-Kagaku 25, 2 (1960) 64-71. (In Japanese, with English summary).

See 652.

652 Saito, T. STUDIES ON THE SELECTIVE TOXICITY OF SCHRADAN. p.255-65 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Schradan has low toxicity for chewing insects (Chilo suppressalis Walker larvae, Periplaneta americana L. adults, Musca domestica vicina Macq. adults) whilst being highly toxic to sucking insects (adults of Leptocorisa varicornis Fabricius, Scotinophara lurida Burmeister, Nephotettix bipunctatus cincticeps Uhler). The absorption, excretion and metabolic rates of P^{32}-schradan in those insects varied considerably. No definite relationships were found between those factors and toxicities, nor between susceptibility of cholinesterases to toxicants and toxicities, but quantitative differences in P^{32}-schradan distribution patterns were found. Much more P^{32}-schradan accumulated in the central nervous systems of sucking insects than in those of chewing insects. Electron microscope observations on the central nervous sheath disclosed that the thoracic ganglia of chewing insects were enclosed in a thick and robust sheath, while those of sucking insects were surrounded by simple, thin double membranes. The selective toxicity of schradan was interpreted to be due to differences in schradan-distribution patterns in insect bodies. The distribution of

toxicants in insects and the character of the nerve sheath, which acts as a barrier against the penetration of toxicants, may be the most important factors responsible for the selective toxicity observed.

II-G-1-s TELODRIN

653 Cox, H.C., Bowman, M.C. UPTAKE OF TELODRIN BY FALL ARMYWORM LARVAE EXPOSED TO RESIDUES. (Abstr.53). Bull. ent. Soc. Amer. 9, 3 (1963) 168.

Following exposure, different instars were analyzed by gas-liquid chromatography and by paper chromatography of C^{14}-labelled Telodrin. Data were obtained on toxicant content in the integument and internal organs and lipid content of full-grown larvae.

654 Hamilton, E.W. METABOLISM OF ALDRIN AND DIELDRIN BY THE AMERICAN COCKROACH, Periplaneta americana (L.). Diss. Abstr. 22, 2 (1961) 417.

Data on the conversion of aldrin to dieldrin and other aldrin metabolites, in vivo, and the effect of selected nucleotides and an enzyme, peroxidase (horseradish), on the epoxidation of aldrin, in vitro, were obtained. Two metabolites of aldrin were detected in the roach extracts: dieldrin and a ketone (metabolite K). Provisional identification of metabolite K (as extracted from sections of paper chromatograms containing the material) with a pure, synthesized dieldrin ketone was shown by a common band of absorbance at 5.72 μ on their infrared spectra. Cyclopentane, a 5-carbon ring ketone, shows the same band of absorbance. The difference in R_f values for metabolite K and dieldrin, however, pointed to a possible difference in the number and placement of the chlorine atoms. The formation of an inorganic chloride is indicated by apparent dechlorination of aldrin and its metabolites in the roach (as shown by difference in conversion detected with C^{14}- and with Cl^{36}-labelled aldrin); the presence of a product III in Cl^{36}-labelled aldrin standard solution, and its absence in C^{14}-labelled aldrin standard solutions; and the formation of significant amounts of III in peroxidase and/or DPN^+ incubation mixtures containing Cl^{36}-labelled aldrin, but not in mixtures containing C^{14}-labelled aldrin. The methylene bridge chlorines are especially labile. Therefore, the methylene bridge could be one of the reactive sites on the aldrin, dieldrin, or dieldrin ketone molecule. Another reactive site is the double bond where the epoxide or ketone is formed. The in vitro data showed that incubation mixtures containing peroxidases and/or DPN^+, roach digestive tract, and aldrin resulted in the conversion of significant amounts of aldrin to dieldrin.

655 Korte, F., Stiasni, M. INSEKTIZIDE IM STOFFWECHSEL. III. MIKROSYNTHESE VON ^{14}C-MARKIERTEM TELODRIN. (Insecticides in metabolism. III. Microsynthesis of C^{14}-labelled Telodrin). Liebigs Ann. 656 (1962) 140-4. (In German).

Two microsyntheses of C^{14}-labelled Telodrin (insecticide R 6700) (exo-cis-1,3-endo-4,5,6,7,10,10-octachloro-4,7-endomethylene-4,7,8,9-tetrahydrophthalan) are described in detail. Starting with $BaC^{14}O_3$ (specific activity 10.8 mc/mM), the total yield was 21% when the terahydrofurane ring was labelled, or 60% relative to the labelled hexachlorocyclopentadiene when the chlorinated ring was marked; details are given in CA 58: 1963, 6777e. Larvae of Aëdes aegypti absorbed Telodrin-3-C^{14} only very slightly; at a concentration of 10 ppm I-3-C^{14} was absorbed to an extent of 1% and converted to 60% VIII (see CA).

II-G-1-t THIODAN

656 Barnes, W.W. THE PENETRATION AND METABOLISM OF THIODAN IN M. domestica. (Abstr.49). Bull. ent. Soc. Amer. 9, 3 (1963) 163.

Female M. domestica of resistant and susceptible strains were treated topically with C^{14}-tagged Thiodan. Rate of penetration and metabolic fate of the insecticide was determined via gas and paper chromatography and autoradiograms. The results indicate varied isomeric penetration and metabolism.

See also:

63 Some results of the use of tracer techniques in the study of plant protection. (Andreev et al., 1958)
207 A new DDT-metabolizing enzyme in the German cockroach. (Agosin et al., 1961)
303 Radiometric assay of acetylcholinesterase. (Winteringham and Disney, 1962)
304 Acetylcholinesterase activity and competitive inhibition at low substrate concentrations. (Winteringham and Disney, 1963)
380 Lipids of DDT-resistant and susceptible larvae of Aedes aegypti. (Fast and Brown, 1962)

412 Radioactive tracer techniques in insect biochemistry. (Winteringham, 1962)
428 The relation between physical properties and penetration of solutes into cockroach cuticle. (Olson and O'Brien, 1963)
500 A new bioassay technique, with special reference to the specific bioassay of DDVP insecticide. (Sun and Johnson, 1963)
506 The action of fumigants on insects. II. The effect of hydrogen cyanide on the activity and respiration of certain insects. (Bond, 1961)
515 The metabolism of naphthalene by house fly microsomes and its inhibition by insecticide synergists. (Schonbrod and Terriere, 1962)
517 Drywood termite metabolism of Vikane fumigant as shown by labeled pool technique. (Meikle et al., 1963)
521 Physiology and biochemistry of resistance to chlorinated hydrocarbons. (Hoskins, 1962)
525 Insecticides in metabolism. II. Metabolism of C^{14}-labelled aldrin and C^{14}-labelled dieldrin in microorganisms, liver homogenates and mosquito larvae. (Korte et al., 1962)
526 Syntheses and studies on some C^{14}-labelled insecticides belonging to the halogenated hydrocarbons and on labelled iridomyrmecin. (Korte et al., 1962)
528 Pick-up and penetration of dieldrin from residual films. (Potter, 1961)
529 Microsyntheses of C^{14}-labelled insecticides and some biochemical studies. (Rechmeier, 1962)
531 Relations between structure, metabolism and toxicity of the 'cyclodiene' insecticides. (Brooks and Harrison, 1963)
534 Penetration of BHC isomers through cuticle of the American cockroaches. (Fukami et al., 1961)
542 Fate of S^{35}-labeled p-chlorophenyl p-chlorobenzenesulfonate in some organisms. (Tomizawa, 1960)
544 The metabolism of C^{14}-labeled DDT in the larvae, pupae, and adults of Drosophila melanogaster. (Menzel et al., 1961)
548 Further investigations into the mechanism of action of the insecticide Thiodan(R). (Gösswald, 1962)
549 Problems of application and action of Thiodan studied with S^{35}-labelled insecticide. (Gösswald et al., 1963)
556 Biological and chemical properties of dimethoate and related derivatives. (Brady and Arthur, 1963)
557 Reaction of certain phosphorothionate insecticides with alcohols and potentiation by breakdown products. (Casida and Sanderson, 1963)
561 Experiments on the control of some species of plant coccids. (Pietri-Tonelli et al., 1961)
568 Metabolism of Famophos in mammals and insects. (Sferra, 1962)
571 Distribution of aerially applied malathion-S^{35} in a forest ecosystem. (Giles and Peterle, 1963)
572 The effect of SKF 525A (2-diethylaminoethyl 2:2-diphenylvalerate hydrochloride) on organophosphate metabolism in insects and mammals. (O'Brien, 1961)
582 Studies on the quantitative uptake of P^{32}-labelled schradan by adults of Dysdercus koenigii Fabricius from insecticidal films. (Rattan Lal et al., 1960)
584 Studies on the mode of action of organophosphorus compounds. Part I. Metabolic fate of P^{32}-labeled Sumithion and methyl parathion in guinea pig and white rat. (Miyamoto et al., 1963)
584 Studies on the mode of action of organophosphorus compounds. Part I. Metabolic fate of P^{32}-labeled Sumithion and methyl parathion in guinea pig and white rat. (Miyamoto et al., 1963)
586 Systemic action of two insecticides on arthropod parasites of rabbits and cattle. (Adkins, 1961)
596 Penetration of pyrethrin I labelled with carbon-14 into susceptible and pyrethroid resistant houseflies. (Fine et al., 1963)
609 Non-hydrolytic pathway in metabolism of Sevin. (Dorough and Casida, 1963)
610 Non-hydrolytic pathway in metabolism of N-methylcarbamate insecticide. (Dorough, 1963)
611 Relation of the rate of penetration and metabolism to the toxicity of Sevin to three insect species. (Eldefrawi and Hoskins, 1961)
643 Selective toxicities of organic phosphorus insecticides. III. An enzyme system included in the cleavage of methyl parathion to demethyl parathion in the supernatant of some types of homogenates. (Fukami and Shishido, 1963)
661 Metabolism of O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate by white rats. (Brady and Arthur, 1961)
662 Absorption and metabolism of Bayer 22408 by dairy cows and residues in the milk. (Buttram and Arthur, 1961)
681 The relation between toxicity and metabolism of paraoxon in the frog, mouse and cockroach. (Potter and O'Brien, 1963)
686 Studies on the translocation of radioactive schradan in plants and its uptake from film by insects. (Chatterji et al., 1961)
1555 Some applications of radioisotopes to the study of the contamination of insects by insecticide solutions. (Lewis, 1963)

II-G-2 INSECTICIDE METABOLISM IN ANIMALS OTHER THAN INSECTS

II-G-2-a GENERAL

657 Arthur, B.W. METABOLISM OF SYSTEMIC AND OTHER RECENT INSECTICIDES IN ANIMALS. p.65-81 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

Review article, with 103 references. Typical biochemical mechanisms are discussed, with specific systemic and non-systemic organophosphate insecticides as illustrations. Organophosphates undergo several activation and detoxication processes in insects and mammals. Detoxication mechanisms of organophosphates include destructive hydrolysis at the P-O-C, P-S-C, P-C, P-N, or P-O-N bonds. Other hydrolytic processes occur at groups not linked to the phosphorus atom. It is stressed that insecticide metabolism studies are basic in understanding the selective toxicity of insecticides, resistance mechanisms, residue problems, and mode-of-action concepts.

658 Филатов, Г.В., Карташов, П.А., Мутин, М.И., Закамырдин, И.А., Узаков, У.Я. ПРИМЕНЕНИЕ РАДИОАКТИВНЫХ ИЗОТОПОВ В ИЗУЧЕНИИ ПРОЦЕССОВ ВСАСЫВАНИЯ, РАСПРЕДЕЛЕНИЯ И ВЫДЕЛЕНИЯ ИЗ ЖИВОТНОГО ОРГАНИЗМА НЕКОТОРЫХ ИНСЕКТИЦИДОВ. Стр. 249-53 в сб. "Применение радиации и радиоизотопов в борьбе с насекомыми—сельскохозяйственными вредителями. Труды Симпозиума, Афины, 22-26 апреля, 1963". Вена, Международное агентство по атомной энергии. 1963.

Filatov, G.V., Kartashov, P.A., Mutin, M.I., Zakamyrdin, I.A., Uzakov, U. Ya. USE OF RADIOISOTOPES IN STUDYING THE ABSORPTION, DISTRIBUTION AND ELIMINATION OF CERTAIN INSECTICIDES IN ANIMALS. p.249-53 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency, 1963.

The paper gives details on the rate at which DDT-C^{14}, polychloropinene-Cl^{36} and chlorophos-P^{32} are absorbed through the skin, accumulated in the organs and tissues and eliminated from the organisms of farm and laboratory animals. Under the experimental conditions described, the DDT retained by the (cow) organism 5 months after spraying was deposited in all organs, and primarily in fatty tissue. Polychloropinene undergoes rapid decomposition and is eliminated in the form of decomposition products. A P^{32}-labelled methyl chlorophos preparation of specific activity 250 mc was also used. When applied externally, chlorophos was detected in the blood within minutes (maximum after 30 min). By the 6th and 7th day, none could be detected in milk. After per os administration of chlorophos to rabbits chlorophos could be identified in urine and liver extracts.

659 Weidhaas, D.E., Schmidt, C.H., Chamberlain, W.F. METABOLISM OF RADIO-LABELLED SYSTEMIC INSECTICIDES IN ANIMALS. p.93-7 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

A summary is presented of research work on the metabolism of radio-labelled systemic insecticides in animals, with details on experimental procedures and important results. Analyses of samples of blood, urine, feces, meat, and milk are made by various methods in order to trace the fate of an insecticide or its associate residues in an animal. Results are cited for numerous insecticides. Studies are also included in which radioisotopes are used to aid research on the mode of action of insecticides and repellents, metabolism of insect repellents, and insecticide resistance problems. (Auth.)

II-G-2-b ALDRIN AND DIELDRIN

660 Kochen, W. UNTERSUCHUNGEN ÜBER DEN STOFFWECHSEL DES ALDRIN-C^{14} IN RATTEN AND KANINCHEN. [ISOLIERUNG VON METABOLITEN]. (Studies on the metabolism of aldrin-C^{14} in rats and rabbits. [Isolation of metabolites]). Diplomarbeit. Bonn, Universität, Institut für Chemie, 1963. 69p. (In German).

Following intravenous injection of aldrin-C^{14} and dieldrin-C^{14}, large quantities of a hydrophilic metabolite could be traced in the excrements. By paper chromatography this metabolite was separated into 2 components. The distribution, elimination and metabolism of aldrin-C^{14} were determined for the rat as follows:

(1) In the organs studied (brain, heart, spleen, testis, kidney, lung and blood) 0.08-0.60% of the injected dose could be recovered, with dieldrin contributing 80-90%. The hydrophilic product occurred in all the organs (lung 35%, kidney 52%, rather less in the rest). Aldrin was found in small quantities in all organs (excepting brain and duodenum). (2) Within 48 h, > 18% of the injected dose were excreted, metabolism to the hydrophilic product accounting for up to 95%. (3) Only ~20% of the injected doses was stored in fat. Although dieldrin is predominant, the hydrophilic product occurs also in abdominal fat. When dieldrin-C^{14} is injected intravenously, the same hydrophilic product can be separated as after aldrin-C^{14}. Experiments In vitro have shown that blood and duodenal secretion are capable of converting 3-5% of aldrin to dieldrin whereas the dieldrin itself undergoes no change. In rat, ~55% of the injected aldrin-C^{14} is eliminated in the faeces within 3 weeks. The hydrophilic product was also isolated from rabbit and separated into 2 components. One of these was identified, following hydrolysis, as the 6,7-diol of aldrin (1,2,3,4,10,10-hexachloro-6,7-dihydroxy-1,4-endo-5,8-exo-dimethano-1,4,4a,5,6,7,8,8a-octahydronaphthaline). The second predominant component was isolated as an oily, yellow product. The mole weight is between 438 and 444. Dieldrin was also isolated in crystalline form and identified.

II-G-2-c BAYER 29493

661 Brady, U.E., Jr., Arthur, B.W. METABOLISM OF O,O-DIMETHYL O-[4-(METHYLTHIO)-m-TOLYL] PHOSPHOROTHIOATE* BY WHITE RATS. J. econ. Ent. 54, 6 (1961) 1232-6.

The insecticide was labelled with P^{32}. O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate (Bayer 29493) was oxidized by rats at the phosphoryl sulfur and the thiophenyl group; the sulfoxide and sulfone derivatives of the parent material and its oxygen analogue were isolated and identified. Oxidation rather than isomerization was the predominant activation process. Hydrolysis occurred primarily at the P-O-phenyl bond; cleavage of the P-O-methyl bond was not demonstrated. The percentage of hydrolytic products in the urine decreased as the number of doses increased (10 mg/kg/day for 10 d). The cholinesterase of the blood and brain of rats was inhibited rapidly and recovered slowly. The acetonitrile-soluble residues in the liver, kidney, muscle, skin, and heart were negligible at 3 d following oral (100 mg/kg) or intraperitoneal treatment of rats. About 80% of the administered Bayer 29493 equivalents was eliminated in the excreta regardless of the route of administration. The absorption and stability of Bayer 29493 in the three species, Musca domestica, Blattella germanica and Anthonomus grandis, is tabulated. The non-hydrolyzed radioactive materials were largely unchanged Bayer 29493 but the insects were capable of oxidizing the thiophosphate and thiophenyl groups to form the 5 possible oxidation products of the parent material. The proportion of each oxidative metabolite was quite variable with the species. Metabolism in cotton plants was also investigated.

* Bayer 29493

II-G-2-d BAYER 22408

662 Buttram, J.R., Arthur, B.W. ABSORPTION AND METABOLISM OF BAYER 22408 BY DAIRY COWS AND RESIDUES IN THE MILK. J. econ. Ent. 54, 3 (1961) 446-51.

P^{32}-labelled Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate) was applied dermally as a 0.5% emulsion to two Holstein dairy cows. Detectable quantities of the intact insecticide were isolated from the milk the first 6 days after treatment. Bayer 22408 equivalents in the milk were about 10 times higher than the actual Bayer 22408. No oxygen analog of the parent compound was isolated from milk, but it was the predominant nonhydrolyzed product of the feces. The faecal metabolites were toxic to stable fly (Stomoxys calcitrans (L.)) larvae, but not to house fly (Musca domestica L.) larvae. (Auth.)

663 Gattderdam, P.E., Chamberlain, W.F., Hopkins, D.E. STUDIES WITH P^{32}-LABELED BAYER 22408 IN STEERS AND GUINEA PIGS. J. econ. Ent. 55, 3 (1962) 326-32.

P^{32}-labelled Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate) was applied dermally and orally to steers at 12 mg/kg and subcutaneously to guinea pigs at levels of 95 and 117 mg/kg respectively. The compound was poorly absorbed through the skin following dermal treatment of a steer. In guinea pigs, Bayer 22408 was eliminated at a faster rate than in the orally treated steer, and the principal excretory route was through the urine rather than the faeces. In steers, the principal metabolite in the urine 2 d

after treatment was diethyl phosphoric acid, whereas the main hydrolysis product in 2nd day samples after treatment of guinea pigs was diethylthiophosphoric acid. Of the total radioactivity in faeces from both steers and guinea pigs at 1 to 5 d post-treatment, significant portions were extractable into organic solvents. Chromatographic analysis of these extracts revealed that the major portion of Bayer 22408 was slowly converted to the oxygen analog, Bayer 25820 (O,O-diethyl O-naphthalimido phosphate). Bayer 22408 proved to be ineffective as a practical systemic against several important livestock pests, but information on its lack of absorption and stability as determined by the radioisotope technique aided in its further evaluation as a contact, residual insecticide. (From auth.)

II-G-2-e BHC

664 Koransky, W., Portig, J., Muench, G. ABSORPTION, DISTRIBUTION, AND ELIMINATION OF α- AND γ-BENZENE HEXACHLORIDE. Arch. exp. Pathol. Pharmak. 244 (1963) 564-75.

The fate of Cl^{36}- or C^{14}-labelled α- (I) or γ-benzene hexachloride (II) after intraperitoneal administration to male albino rats at 40-200 mg/kg as a 2% solution in rape-seed oil, was studied after separation by ascending paper chromatography of extracts of the organs of sacrificed animals and of the excreta. About 35 and 90% of the II was absorbed by the body within 1 and 24 h, respectively. About 75% of the absorbed I and II were apparently uniformly distributed in fat depots, skin, and muscle lipids, in which they were stored unchanged. The residual I and II were present mainly in liver and in the digestive tract. Autoradiographic studies of microtome sections showed a high concentration of I-C^{14} in distinct regions of the central nervous system. Both isomers undergo dechlorination in vivo, and were converted to H_2O-soluble compounds excreted mainly by the kidneys. Small amounts of unchanged I, but none of the II were detected in faeces. About 95% of the activity was excreted in urine and faeces within 20 d; II was eliminated faster than I. The excretion of Cl^{36} was complete after 40 d. (CA 59: 1963, 9228g)

II-G-2-f CCl_4

665 Maling, H.M., Frank, A., Horning, M.G. EFFECT OF CARBON TETRACHLORIDE ON HEPATIC SYNTHESIS AND RELEASE OF TRIGLYCERIDES. Biochim. biophys. Acta 64 (1962) 540-5.

The effect of administering CCl_4 to rats on the incorporation of palmitate-1-C^{14} into liver and plasma lipids was determined. The CCl_4 caused a decrease in plasma triglyceride concentration. After palmitate-1-C^{14} was injected, labelled triglycerides appeared in the plasma in small amounts in treated rats compared to control animals. While in treated rats label was incorporated into liver triglycerides rapidly, in control rats there was a 10-20 min lag. Total radioactivity incorporated into liver triglycerides and phospholipids was greater in treated than in control rats. It is suggested that the increase in liver triglycerides caused by CCl_4 results from both increased hepatic synthesis and impaired release of triglycerides from liver to plasma. (CA 58: 1963, 3744a)

II-G-2-g Co-Ral

666 Krueger, H.R. METABOLISM AS FACTOR IN SELECTIVITY OF ORGANOPHOSPHATE INSECTICIDES. Diss. Abstr. 21 (1961) 2839-40.

P^{32}-labelled Bayer 21/199* (Co-Ral), applied dermally, was found in the urine with part of the excreted radioactivity partitioned with the lactone ring open and the rest of the molecule intact. The low toxicity of malathion to the German cockroach (as compared with the toxicity to the American cockroach and the housefly) is explained by low penetration through the cuticle. The metabolites of malathion found in insects and mice showed a predominance of phosphatase and carboxyesterase activity in insects and of the latter activity in mice. The low toxicity to mice is explained by the comparatively extensive degradation observed in mice. Similar differences in detoxification were found for other insecticides. The enzymic activities of insect homogenates were examined. (From J. Sci. Food Agric. 13, 5 (1962) i-173)

* O,O-diethyl O-3-chloro-4-methyl-7-coumarinyl phosphorothioate.

II-G-2-h DDT

667 Holden, A.V. A STUDY OF THE ABSORPTION OF ^{14}C-LABELLED DDT FROM WATER BY FISH. Ann. appl. Biol. 50, 3 (1962) 467-77.

C^{14}-DDT absorbed by Salmo trutta from 0.5 and 0.1 ppm aqueous suspensions was found in all 14 organs and tissues examined, using a direct mount method on lipid extracts. The concentration in the gills was proportional to the aqueous concentration at death, but about 280 times greater. DDT in the gills, heart and liver was wholly or largely present in the blood in these organs. Storage occurred mainly in the stomach, pyloric caeca, intestine, spleen, muscle and skin, and possibly in the kidneys. Concentrations per unit weight of lipid showed more uniformity than per unit weight of tissue. Concentration in the lipids may determine toxicity to fish, explaining the greater susceptibility to DDT of fish in poor condition or of low fat content. Absorption from the water was very rapid, indicating that static water testing of insecticide toxicity to fish is unreliable. (Auth.)

668 Premdas, F.H., Anderson, J.M. UPTAKE AND DETOXIFICATION OF C^{14}-LABELED DDT IN ATLANTIC SALMON. J. Fish. Res. Bd Can. 20, 3 (1963) 827-37.

Salmo salar salar underyearlings were exposed to 1 ppm DDT-C^{14} and amounts of DDT adsorbed on external surfaces and absorbed internally were determined on the basis of C^{14} activity. Fish killed by exposure contained an average of 5.87 ppm DDT, of which approximately 67% was absorbed DDT. After a 5-min exposure, appreciable amounts were found throughout the body. High concentrations of DDT were found in the gills, liver, spleen, heart, kidney, gonads and swim bladder. Much smaller concentrations occurred in the stomach, intestines, brain, and spinal cord. The muscles, bone, and integument contained the least. It was concluded that DDT entered the body through the gills. Bioassays showed that an average of 67% of absorbed DDT was non-toxic to mosquito larvae. The adsorbed DDT showed little loss of toxicity. (CA 59: 1963, 10511f)

II-G-2-j DFP

669 Kurth, D., Athens, J.W., Cronkite, E.P., Cartwright, G.E., Wintrobe, M.M. LEUKOKINETIC STUDIES. V. UPTAKE OF TRITIATED DIISOPROPYL FLUOROPHOSPHATE (DFP) BY LEUKOCYTES. Proc. Soc. exp. Biol., N.Y. 107 (1961) 422-6.

When leukocytes from normal subjects and patients with leukemia were labelled with H^3-DFP in vitro, myelocytes labelled most intensely. Metamyelocytes and polymorphonuclear neutrophils contained about half as many labelled grains/cell as the myelocytes. Lymphocytes, eosinophils, and basophils did not bind significant amounts of H^3-DFP under the conditions of the experiment; a few monocytes were lightly labelled. Granulocytes in both blood and bone marrow were labelled after intravenous injection of H^3-DFP; the relative degree of labelling was: blood polymorphonuclear neutrophils 1.0, marrow polymorphonuclear neutrophils 0.3, marrow metamyelocytes 0.2, and marrow myelocytes 0.6. None of the other formed elements in either blood or bone marrow contained significant amounts of the label. (CA 55: 1961, 25042e) Also published as BNL-5442, Brookhaven National Lab., Upton, N.Y. 1960. 16p.

II-G-2-k DIAZINON

670 Kaplanis, J.N., Louloudes, S.J., Roan, C.C. THE DISTRIBUTION AND EXCRETION OF P^{32}-LABELED DIAZINON IN GUINEA PIGS. Trans. Kans. Acad. Sci. 65, 1 (1962) 70-5.

The distribution and elimination of P^{32}-labelled diazinon and/or metabolic products have been studied in guinea pigs following both oral and subcutaneous administration. The urine was the major route of elimination following administration by either method. The more rapid rate of excretion and the relative percentages of the dose in the urine and faeces following oral administration demonstrate that diazinon is efficiently absorbed from the digestive tract of the guinea pig. The accumulation of radioactive compounds in the caecum of the guinea pig following subcutaneous injection indicates that this tissue may play a role in metabolism or elimination of diazinon and/or its metabolites. (Auth. summary)

671 Millar, K.R. DETECTION AND DISTRIBUTION OF ^{32}P LABELLED DIAZINON IN DOG TISSUES AFTER ORAL ADMINISTRATION. N.Z. Vet. J. 11, 6 (1963) 141-4.

672 Williams, P.P., Robbins, J.D., Gutierrez, J., Davis, R.E. RUMEN BACTERIAL AND PROTOZOAL RESPONSES TO INSECTICIDE SUBSTRATES. Appl. Microbiol. 11, 6 (1963) 517-22.

Organophosphate insecticides, chlorinated hydrocarbons and carbamates were tested with bovine ruminal ingesta fractions from 10-month-old calves reared in isolation, and previously inoculated with single species of protozoa. Diazinon-C^{14} [O,O-diethyl-1-C^{14}-O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate] substrate uptake was demonstrated with suspensions of Entodinium simplex and Isotricha intestinalis. Rumen ciliates are suggested as a possible means of screening out useful insecticides susceptible to microbial dissimilation for use on forage and other cattle-feed crops.

II-G-2-l DIMETHOATE

673 Chamberlain, W.F., Hopkins, D.E., Gatterdam, P.E. THE METABOLISM OF P^{32}-LABELED DIMETHOATE IN SHEEP. J. econ. Ent. 54, 4 (1961) 733-40.

The metabolism and associated residues following intramuscular injection and oral feeding of 7 sheep were determined with P^{32}-labelled dimethoate. Degradation of dimethoate was rapid and almost quantitative for all sheep, and appeared not to be significantly affected by the route of administration. Only trace residues were found in tissues of sheep sacrificed 2 and 4 weeks post-treatment. Cleavage occurred at several sites on the dimethoate molecule, but to the greatest extent, initially, at the carbonyl-nitrogen bond. Evidence is presented for the occurrence of a previously unreported desalkyl derivative of dimethoate. (Auth.)

II-G-2-m DIPTEREX

674 Kühnert, M., Dedek, W., Schwarz, H. STUDIES ON INFLUENCING METABOLISM AND ON THE PRECIPITATION MECHANISM OF THE PHOSPHONIC ACID ESTER, TRICHLORPHON* IN THE COMMERCIAL PRODUCT "BUBULIN" WITH THE HELP OF ^{32}P-LABELLED PHOSPHOR IN THE INTRAVENOUS AND INTRAMUSCULAR INJECTION TO CATTLE. (B. Agr. 27: 1964, 102955). Arch. exp. VetMed. 17, 2 (1963) 403-17. (In German).

* Dipterex

II-G-2-n GC 4072

675 Chamberlain, W.F., Hopkins, D.E. ABSORPTION AND ELIMINATION OF GENERAL CHEMICAL 4072 APPLIED DERMALLY TO CATTLE. J. econ. Ent. 55, 1 (1962) 86-8.

Studies were conducted on the absorption and elimination of P^{32}-labelled General Chemical 4072 (2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate) when sprayed on cattle at dosages equivalent to conventional 0.1%, 0.25%, and 0.5% sprays. The amount of radioactive material in the blood reached a maximum concentration 2 h after treatment, which indicated rapid absorption of the insecticide or its products by the skin of cattle. The elimination of the insecticide or its products was also rapid, as shown by the low concentrations in the urine and faeces 1 week after treatment. Urinary excretion accounted for 25% to 32% of the applied doses, whereas faecal elimination accounted for 1.8% to 2.1%. (Auth.)

II-G-2-o MALATHION

676 O'Brien, R.D., Niedermeier, R.P., Dauterman, W.C. THE METABOLISM OF ORALLY ADMINISTERED MALATHION* BY A LACTATING COW. J. agric. Food Chem. 9, 1 (1961) 39-42.

Malathion was rapidly excreted by a lactating cow, principally via the urine, which accounted for 90% of the excreted material. About 23% of the dose was not excreted over 3 weeks. As in non-ruminants, the major metabolite was produced by carboxyester hydrolysis; the principal faecal metabolite, however,

* O,O-dimethyl S-1,2-bis(carboethoxy)ethyl phosphorodithioate

was dimethyl phosphate. Milk contained no malathion or malaoxen, but had 0.11 ppm of radioactive materials, most of which could not be identified. Blood metabolites were also examined. P^{32}-labelled malathion was used. (Essentially auth.)

677 Peterle, T.J., Giles, R.H., Jr. NEW TRACER TECHNIQUES FOR EVALUATING THE EFFECTS OF AN INSECTICIDE ON THE ECOLOGY OF A FOREST FAUNA. Technical Progress Report No.1 Dec. 1, 1960 - Aug. 31, 1961. TID-13650, Ohio State Univ. Research Foundation, Columbus, 31 Aug. 1961. 22p.

The development of trapping techniques for sampling forest fauna populations is described. The methods used to prepare S^{35}-labelled malathion O,O-dimethyl S-(1,2-dicarboethoxyethyl) phosphorodithioate are discussed. Progress is reported on the project for evaluating the effects of malathion spraying on the ecology of a forest fauna. (NSA 15: 1961, 28910)

II-G-2-p PARATHION AND PARAOXON

678 Fredriksson, T., Bigelow, J.K. STUDIES ON THE PERCUTANEOUS ABSORPTION OF PARATHION AND PARA-OXON. II. DISTRIBUTION OF ^{32}P-LABELLED PARATHION WITHIN THE SKIN. Acta derm.-venereol., Stockh. 41 (1961) 344-52.

The distribution of P^{32}-labelled parathion within the skin following topical application for ½, 1, 2, 4, and 24 h was studied in excised skin from man, rat, rabbit, and cat. Two different approaches were chosen: 1) (a) determination of radioactivity in 25 consecutive cellulose tape strips from the surface of human skin, (b) autoradiography of the same strips; and 2) autoradiography of skin sections with the use of 4 different techniques. Various factors influencing the autoradiograms were studied, special attention being paid to artefacts due to diffusion, type of radiation, and exposure time of the photosensitive material. It was found that parathion penetrates into hair follicles and sebaceous glands to some extent, but it was concluded that this is not necessarily the main route of absorption. There also was increasing activity below the epidermal layers, and transepidermal absorption is as likely.

679 Fredriksson, T., Bigelow, J.K. TISSUE DISTRIBUTION OF P^{32}-LABELED PARATHION. AUTORADIOGRAPHIC TECHNIQUE. Arch. envir. Hlth 2, 6 (1961) 663-7.

The tissue distribution of P^{32}-labelled Parathion (E 605, diethyl 4-nitrophenyl thionophosphate) has been investigated by means of an autoradiographic technique applied to sections of whole mice. The animals were injected subcutaneously and were killed at various intervals up to 4 h after injection. The material was absorbed very slowly from the subcutaneous deposit. The level of radioactivity in blood was low during the whole period of observation. However, the labelled material accumulated in various organs and tissues. The highest activity appeared in the salivary glands and cervical brown fat (hibernating gland). Liver, kidney, and adipose tissues showed high uptake of radioactivity, and fairly high activity was found in gastric and intestinal walls, thyroid, spleen, and lungs. Less activity was noted in the central nervous system, musculature, and bone marrow. The labelled material was mainly excreted by the kidneys and not in bile or via the intestinal mucosa. The results have been discussed with special regard to the formation of P^{32}-containing metabolites and breakdown products. The relationship between the distribution of the material and the sequence in which systemic symptoms appear in Parathion intoxications has been pointed out. The fact that the actual tissue distribution of a cholinesterase inhibitor need not necessarily follow the pattern indicated by the enzyme inhibition has been stressed. (Auth.)

680* Gar, K.A., Sazonova, N.A., Fadeev, Yu.N. PENETRATION AND METABOLISM OF TWO ORGANOPHOSPHORUS INSECTICIDES BY THE ORGANS OF WARM BLOODED ANIMALS. p.208-17 in "Trudy Pervof Vsesoyuznof Nauchnof Konferentsii po Gigiene, Toksikologii i Klinikologii Novykh Insektofungitsidov, Kiev, 1957". 1959. (In Russian).

Estimations were made of the P^{32} in the blood and urine at intervals after introducing parathion (I) into the stomachs of rabbits (25 mg/kg) and cats (6 mg/kg). The concentration after 1 oral dose of metaphos* (75 mg/kg) was measured at times between 1 min and 15 d in the liver, kidney, brain, spinal cord, medulla oblongata, blood, and urine of female guinea pigs. The distribution of I was measured in the liver, kidney, brain, medulla oblongata, and thyroid of guinea pigs and rabbits. (CA 55: 1961, 1923i).

* Mixture of parathion and methyl parathion

681 Potter, J.L., O'Brien, R.D. THE RELATION BETWEEN TOXICITY AND METABOLISM OF PARAOXON IN THE FROG, MOUSE AND COCKROACH. Ent. exp. appl. 6, 4 (1963) 319-25.

Apparently high levels of paraoxon without increased toxicity in insects treated with parathion might be due to examination of the whole body and not the nervous system alone. Since paraoxon has been shown to be much less toxic to frogs and toads than to mice, tests were carried out in which paraoxon labelled with P^{32} was injected intraperitoneally into mice and frogs and intra-abdominally into females of Periplaneta americana (L.), after which the brains of the frogs and mice and the ventral nerve cords of the cockroaches were removed and the nervous tissues and remaining whole bodies homogenised for testing. Paraoxon was degraded extremely rapidly in the intact mouse and about half as fast in the frog and cockroach. At no time were the paraoxon levels in body and central nervous system substantially different. Paraoxon in vitro had relative potencies against nerve cholinesterase of mouse, frog and cockroach of 79:1:8. Its relative LD_{50}'s by injection were 3.3:73:1. It is concluded that the insensitivity of the frog is due to its insensitive cholinesterase and is unconnected with degradation rates.

II-G-2-q VAPONA

682 Casida, J.E., Niedermeier, R.P., McBride, L. METABOLISM OF 2,2-DICHLOROVINYL DIMETHYL PHOSPHATE IN RELATION TO RESIDUES IN MILK AND MAMMALIAN TISSUES. J. agric. Food Chem. 10, 5 (1962) 370-7.

The metabolism and residues of 2,2-dichlorovinyl dimethyl phosphate-P^{32} (DDVP or Vapona) were examined with rats, cows, and a goat. Studies with rats also utilized carbon labelled DDVP, dichloroacetaldehyde, and dichloroethanol, and P^{32}-labelled O-methyl 2,2-dichlorovinyl phosphate and O,O-dimethyl phosphate. In addition, several rats and a single cow were treated orally with 1,2-dibromo-2,2-dichloroethyl dimethyl phosphate-P^{32} (Dibrom). These insecticides are rapidly hydrolyzed in mammals containing metabolites of DDVP, O,O-dimethyl phosphate and O-methyl 2,2-dichlorovinyl phosphate, are low in toxicity and rapidly excreted or further degraded. The 1-carbon of the 2,2-dichlorovinyl group in DDVP is excreted in urine predominantly as a conjugate of dichloroethanol, probably the glucuronide, in the faeces as unknown derivatives, and in the expired air as carbon dioxide. Small amounts of dichloroacetic acid may be formed, and some of the C^{14} persists in liver, blood, and other tissues in an unidentified form. Limited metabolism studies of DDVP in plants and of DDVP and Dibrom in bovine rumen fluid are also reported. (Auth.)

683 Hodgson, E., Casida, J.E. MAMMALIAN ENZYMES INVOLVED IN THE DEGRADATION OF 2,2-DICHLOROVINYL DIMETHYL PHOSPHATE (DDVP). J. agric. Food Chem. 10 (1962) 208-14.

The metabolic fate of DDVP by the action of mammalian enzymes is studied in vitro using C^{14}-labelled DDVP. Whole homogenates of liver, kidney, spleen and adrenal glands of rat and rabbit convert DDVP mainly to dimethyl phosphate but some des-methyl DDVP, monomethyl phosphate and inorganic phosphate are also formed. No evidence of any other P containing metabolites was obtained. Dimethyl phosphate accounts for 98% to 100% of the DDVP hydrolysed by the plasma of both species. Liver enzymes metabolize des-methyl DDVP further via dichloroacetaldehyde to dichloroethanol and possibly dichloroacetic acid. The stimulatory or otherwise effect of various cations, e.g., Mn and Co, on the enzyme activities is examined and the mechanisms of the hydrolysis of DDVP in these systems are discussed. (J. Sci. Food Agric. 13, 5 (1962) 11-280)

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See also:

- 497 Radioisotopes in the study of the fate of insecticides applied to animals and plants. (Plapp and Lindquist, 1963)
- 523 Cl^{36}-dieldrin in mice. (Heath, 1962)
- 525 Insecticides and metabolism. II. Metabolism of C^{14}-labelled aldrin and C^{14}-labelled dieldrin in microorganisms, liver homogenates and mosquito larvae. (Korte et al., 1962)
- 526 Syntheses and studies on some C^{14}-labelled insecticides belonging to the halogenated hydrocarbons and on labelled Iridomyrmecin. (Korte et al., 1962)
- 527 The excretion of C^{14}-labelled aldrin and dieldrin as well as their metabolites via the bile. (Mörsdorf et al., 1963)

529 Microsyntheses of C^{14}-labelled insecticides and some biochemical studies. (Rechmeier, 1962)

538 The metabolism of hexachlorocyclohexane isomers and the effect of microsome-activating drugs. (Koransky and Portig, 1962)

540 Absorption, distribution and excretion of hexachlorocyclohexane isomers in relation to their anticonvulsive effect. In: 3rd Spring meeting of the German Pharmacological Association, 1962. (Portig and Koransky, 1962)

545 Metabolism of chlorophenothene (DDT). (Rothe et al., 1957)

547 Synthesis of Telodrin-C^{14} and its transformation by microorganisms, mosquito larvae and rats. (Stiasni, 1962)

554 Metabolism of radiolabeled 3-(dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide (Bidrin, SD 3562) in beans and mammals. (Menzer, 1963)

556 Biological and chemical properties of dimethoate and related derivatives. (Brady and Arthur, 1963)

557 Reaction of certain phosphorothionate insecticides with alcohols and potentiation by breakdown products. (Casida and Sanderson, 1963)

568 Metabolism of Famophos in mammals and insects. (Sferra, 1962)

571 Distribution of aerially applied malathion-S^{35} in a forest ecosystem. (Giles and Peterle, 1963)

572 The effect of SKF 525A (2-diethylaminoethyl 2:2-diphenylvalerate hydrochloride) on organophosphate metabolism in insects and mammals. (O'Brien, 1961)

578 Toxicological studies of organophosphate anthelmintics. (Timmerman, 1963)

579 The penetration of an anticholinesterase agent (Sarin) into skin. II. Autoradiographic studies. (Blank et al., 1958)

580 Percutaneous absorption of Sarin and two allied organophosphorus cholinesterase inhibitors. (Fredriksson, 1958)

581 The distribution of radioactive phosphorus in the blood and tissues of rabbits treated with tagged isopropyl methylphosphonofluoridate (Sarin). (McPhail and Adie, 1960)

584 Studies on the mode of action of organophosphorus compounds. Part I. Metabolic fate of P^{32}-labeled Sumithion and methyl parathion in guinea pig and white rat. (Miyamoto et al., 1963)

586 Systemic action of two insecticides on arthropod parasites of rabbits and cattle. (Adkins, 1961)

592 Radioactive-labelled phosphoric acid esters. III. The fate of P^{32}-labelled Wotexit following intravenous or intramuscular injection in cattle. (Dedek and Kühnert, 1962)

609 Non-hydrolytic pathway in metabolism of Sevin. (Dorough and Casida, 1963)

610 Non-hydrolytic pathway in metabolism of N-methylcarbamate insecticide. (Dorough et al., 1963)

613 Conjugates of carbamate metabolism of Sevin. (Leeling and Krishna, 1963)

634 Insecticides in metabolism. IV. Iridomyrmecin-(3-C^{14}). (Korte and Schreiber, 1962)

659 Metabolism of radio-labelled systemic insecticides in animals. (Weidhaas et al., 1962)

703 Residue and metabolism of radioactive 4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate administered as a single oral dose to sheep. (Bauriedel and Swank, 1962)

716 Percutaneous absorption of parathion and paraoxon. IV. Decontamination of human skin from parathion. (Fredriksson, 1961)

II-G-3 INSECTICIDE METABOLISM IN PLANTS

II-G-3-a GENERAL

684 Casida, J.E. METABOLISM OF ORGANOPHOSPHATE INSECTICIDES BY PLANTS: A REVIEW. p.49-63 in "Radioisotopes and Radiation in Entomology. Proceedings of a Symposium, Bombay, 5-9 December 1960". Vienna, International Atomic Energy Agency. 1962.

Current knowledge of the metabolic fate of insecticides in plants is reviewed and documented (104 references), with particular attention to the synthetic routes available for labelling organophosphates with P^{32} and the use of these compounds in metabolism studies. Radioisotopes are considered to provide the most certain method for establishing the metabolic pathway of an insecticide. A detailed table on radiotracer studies on the metabolism of organophosphate insecticides by plants is included which gives details of absorption and translocation, hydrolysis products and non-hydrolyzed metabolites.

II-G-3-b COCOA

685 West African Cocoa Research Inst. ANNUAL REPORT OF THE WEST AFRICAN COCOA RESEARCH INSTITUTE, 1959-60. London, Crown Agents. 1961. 89p.

Armstrong states that, in screening tests of 9 systemic and semi-systemic insecticides, dimethoate (Rogor 40) and methyl-demeton (Meta systox) appeared likely to be the most useful of foliar sprays. In an experiment in which mature leaves at the distal ends of fans and chupons were painted with P^{32}-labelled dimethoate, radioactivity was detected at mean distances from fans and chupons, respectively, of 14 and 19 inches after 1 d. and 72 and 54 inches after 14 d. (From RAE-A 51: 1963, 116).

II-G-3-c COTTON

686 Chatterji, S., Rahalkar, G.W., Sethi, G.R., Saxena, P.N. STUDIES ON THE TRANSLOCATION OF RADIOACTIVE SCHRADAN IN PLANTS AND ITS UPTAKE FROM FILM BY INSECTS. Curr. Sci. 33, 3 (1961) 105-6.

P^{32}-labelled schradan solutions were used in dipping and irrigation experiments on cotton seedlings, and cotton and sugarcane plants, respectively. Rate and degree of translocation indicated that schradan is absorbed by the roots of the plant, the rate of subsequent translocation varying with the species. Uptake of schradan from film was tested on nymphs and adults of Dysdercus koenigii Fabr. (pretreated at various temperatures, then released on filter paper soaked in 1 ml of 0.5% solution of radioactive schradan). All nymphs were dead by the 2nd day. Schradan was picked up from film in considerable quantities, confirmed by assays on dead and live insects. The uptake apparently increased with rise in temperature.

687 Hacskaylo, J., Lindquist, D.A., Clark, J.C. PHORATE ACCUMULATION BY COTTON PLANTS AND RECOVERY FROM SOIL. J. econ. Ent. 54, 3 (1961) 411-3.

Small-plot field tests were used to study phorate uptake by cotton plants following seed and in-furrow granular applications; phorate recovery from the soil was studied also. In-furrow granular treatments with phorate reduced phytotoxicity and gave aphid control similar to that with the standard carbon seed treatment. Studies with P^{32}-labelled phorate showed similar amounts of phorate-equivalents in plants treated by both methods. Radioassay of soil cores showed 70% or more of the radioactivity in the top 1.5 inches 1 to 7 weeks after planting. The combined quantities of radioactivity extractable with chloroform and water decreased with time to a low of about 25% in each of the treatments. Generally, similar amounts of radioactivity were recovered in the chloroform and water extracts. (Auth.)

688 Hacskaylo, J., Lindquist, D.A., Davich, T.B. DIMETHOATE ABSORPTION AND ITS TRANSLOCATION AND DISTRIBUTION IN THE COTTON PLANT. J. econ. Ent. 54, 6 (1961) 1206-9.

Cotton plants grown in sand culture treated with P^{32}-labelled dimethoate accumulated more insecticide in the leaves under environmental conditions which favoured transpiration. Fruiting cotton plants treated with dimethoate as a soil drench accumulated relatively small amounts of the toxicant in the squares and bolls. Less than 1 µg of dimethoate-equivalents was found in the stamens plus pistil of squares upon which the developing boll weevil (Anthonomus grandis Boheman) larvae feed. Young cotton plants grown in dimethoate-treated nutrient solutions did not absorb the insecticide at the same rate they absorbed water. Also, plants grown in nutrient solutions deficient in phosphorus absorbed less insecticide than plants grown in a complete nutrient solution. (Auth.)

689 Hacskaylo, J., Bull, D.L. METABOLISM OF DIMETHOATE IN COTTON LEAVES. J. agric. Food Chem. 11, 6 (1963) 464-6.

The excised-leaf technique was used. P^{32}-labelled dimethoate was used, with a final 99% purity and a specific activity of 3930 cpm/µg. The half life of the systemic insecticide was 1.8 d through 4 half lives, but increased slightly thereafter. 11 metabolites were resolved by paper chromatography, and 8 of these were identified. The metabolite found in largest amount was the carboxy derivative. The oxygen analogue remained relatively constant but consistently less than 6% of the total metabolites recovered. The proposed metabolic degradation of dimethoate after its introduction directly into the cotton leaves is similar to that found in mammals but dissimilar to that reported when the insecticide was applied as a foliar spray. Its metabolism in leaves deficient in N, P, and Fe is also reported.

690 Hascoet, M. ÉVOLUTION DES DÉPÔTS SUPERFICIELS, DIFFUSION ET DÉGRADATION DE DEUX INSECTICIDES ENDOTHÉRAPIQUES: LE DÉMÉTON-S ET L'ENDOTHION DANS QUELQUES PLANTES MARAÎCHÈRES. p.195-210 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

En l'absence de précipitations atmosphériques, la détoxication des plantes traitées à l'aide d'insecticides endothérapiques dépend à la fois de l'inactivation des dépôts superficiels et de la dégradation du pesticide dans le végétal. Ces deux phénomènes ont été suivis sur plusieurs plantes maraîchères traitées au déméton-S et à l'endothion, marqués respectivement avec ^{32}P et ^{35}S. La vitesse d'inactivation des dépôts superficiels est comparable pour l'endothion et le déméton-S, lorsque les conditions extérieures sont elles-mêmes voisines. Au niveau du feuillage, la persistance du déméton-S et de ses métabolites actifs varie selon la plante traitée. Elle est en général supérieure à celle de l'endothion dont le schéma de désintégration ne comprend que des produits d'hydrolyse atoxiques. Dans les fruits traités au déméton-S, la dégradation apparente semble très rapide; pour l'endothion, au contraire, elle reste comparable à celle que l'on observe dans le feuillage et ne semble pas affectée par la maturité des fruits. Les résidus toxiques retrouvés dans les fruits peuvent être dus, soit à une diffusion de l'insecticide provenant du feuillage, soit à une contamination directe. L'importance relative de ces deux phénomènes a pu être précisée grâce à une étude comparative des fruits, traités ou non, portés par une plante elle-même traitée. La pénétration et la diffusion du déméton-S et de l'endothion dans les pousses d'asperges sont étudiées afin de tenter d'expliquer le comportement de ces deux insecticides dans la lutte contre la mouche (Platyparea poecilloptera). Le mémoire met en évidence le rôle important que peut jouer le mouillant.

691 Lindquist, D.A., Hacskaylo, J., Davich, T.B. ABSORPTION AND TRANSLOCATION OF PHORATE* AND PHOSPHORUS BY COTTON SEEDLINGS. Bot. Gaz. 123 (1961) 137-40.

Absorption of P^{32}-labelled phorate by the seedlings depended on the volume of the radicle or hypocotyl exposed to the substance. $H_3P^{32}O_4$ was translocated downward in the plants more rapidly than was phorate; the reverse was true of upward translocation. (J. Sci. Food Agric. 13, 9 (1962) ii-89).

* O,O-diethyl S-(ethylthio)methyl phosphorodithioate

692 Lindquist, D.A., Hacskaylo, J., Davich, T.B. LABORATORY AND FIELD INVESTIGATIONS WITH PHORATE-TREATED COTTON SEEDS. J. econ. Ent. 54, 2 (1961) 379-85.

The absorption of P^{32}-labelled phorate by cotton seeds was investigated under laboratory, greenhouse, and field conditions. Dehulled seeds absorbed much more phorate than intact seeds; however, this increased amount of phorate in the dehulled seed did not reduce germination or radicle growth. Absorption of inorganic P^{32} was not appreciably inhibited by the seed coat. Water absorption and respiration of germinating cotton seeds was not markedly different between untreated and treated seeds. Cotton plants grown in sand and soil from phorate-treated seeds absorbed 2% to 6% of the applied dosage, chiefly during the first 7 d after planting. (Auth.)

693 Lindquist, D.A., Hacskaylo, J., Clark, J.C., Davich, T.B. SYSTEMIC ACTIVITY OF DIMETHOATE APPLIED TO COTTON SEEDS. J. econ. Ent. 54, 6 (1961) 1132-5.

Dimethoate was not exceptionally effective as a systemic cottonseed treatment against the boll weevil (Anthonomus grandis Boheman) and cotton aphid (Aphis gossypii Glover). Applied as a seed treatment, dimethoate caused considerable reduction in seedling emergence. Studies with P^{32}-labelled dimethoate applied as a cottonseed treatment indicated that the toxicant was most rapidly absorbed 1 to 3 d after planting. Dimethoate seed treatment did not reduce the total emergence of artificially deteriorated seed, but did reduce the rate of emergence somewhat. Seeds deteriorated for 2 d absorbed more dimethoate than seeds deteriorated for 0, 1, 3, or 4 d. Dimethoate was found to be less toxic than phorate to boll weevil larvae and adults. (Auth.)

694 Tsao, C.H., Clark, E.W. ABSORPTION AND TRANSLOCATION OF DI-SYSTON BY COTTON PLANTS. J. econ. Ent. 54. 6 (1961) 1228-9.

The absorption and translocation of P^{32}-labelled Di-Syston (O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate) were studied by means of foliar, seed, and soil treatments. The compound was readily translocated to leaves and stems from treated leaves or roots, but in these limited experiments it did not concentrate in fruiting forms. Distribution of Di-Syston leached from germinated and ungerminated treated cottonseed into the surrounding soil showed definite downward and, to a lesser degree, lateral movement. (Auth.)

II-G-3-e GRAPE VINE

695 Coombe, B.G. ABSORPTION AND MOVEMENT OF PHOSPHORUS-32-LABELLED SYSTEMIC INSECTICIDES IN THE GRAPE VINE (Vitis vinifera L.). Aust. J. agric. Res. 13 (1962) 17.

Schradan, dimefox and demeton-S, containing P^{32}, were applied by different methods at different times to study their behaviour, particularly their accumulation in roots, as a means of controlling the root-sucking pest, Phylloxera vitifoliae. Foliage sprays, 'capsule' treatment, and banding of the trunk (with various treatments such as cincturing, abrasion and twig removal) gave low insecticide levels in the roots, but sometimes high levels in the leaves. Watering in November and February, and shoot injection in April, have 17 mg of schradan per kg of roots, 15 d after treatment, and decomposition was slow. Dimefox was absorbed to a similar extent but decomposed rapidly and was phytotoxic when applied in a trunk band. Demeton-S gave low root levels and did not move easily in the phloem.

II-G-3-f PINE APPLE

696 Gorner, W.A. RADIOISOTOPE STUDIES OF PESTICIDE METABOLISM BY THE PINEAPPLE PLANT. Int. J. appl. Rad. Isotopes 13 (1962) 395-7.

Review of relevant activities in author's institute. C^{14}, P^{32} and S^{35} were used in a series of studies. Radioactive Systox, di-syston (Bayer 19639) and dimethoate were studied as systemic insecticides. Results of experiments with S^{35} indicated that inadequate insect control was not due to detoxification or immobilization mechanisms in the plant, but rather to inadequate penetration of the insecticide into tissues at the sites of application. Radioactive mealybugs (Pseudococcus brevipes) were obtained by feeding on C^{14}-labelled pineapple leaves or nutrient media containing P^{32}. Paper chromatography and subsequent autoradiography permitted identification of the free tagged amino acids and sugars in the insects themselves, in their oral secretions and in their excretions. Some interesting differences were observed in the autoradiographs.

II-G-3-g POPLAR

697 Catrina, I., Popa, A., Constantinesco, V., Constantinesco, O., Constantinesco, El., Huluta, C. L'ÉTABLISSEMENT DES PROCESSUS D'ABSORPTION ET DIFFUSION DES INSECTICIDES SYSTÉMIQUES AU Populus X euramericana de Guinier "robusta". p.211-20 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Pour étudier le mécanisme d'absorption, de diffusion et de localisation des insecticides systémiques en ce qui concerne les peupliers et les saules, espèces fréquemment attaquées par les insects xylophages, on a fait des recherches en employant le «Dipterex» marqué sur le peuplier Robusta R20. Le marquage de l'insecticide a été fait dans un réacteur, en utilisant comme cible le Dipterex en poudre (1,5 g), avec un flux $\Phi = 10^{11}$ n/cm^2·s et à une température de 30 à 40°C. L'irradiation a été effectuée jusqu'à l'obtention d'une activité absolue de la cible ≈ 1 mc. Tant en laboratoire qu'en pépinière, l'insecticide a été accumulé en plus grande proportion dans les feuilles. Pourtant, on constate une augmentation importante des accumulations d'insecticide dans les rameaux et dans le bois de la tige, surtout au bout des plants, dans l'expérience en pépinière. En général, l'accumulation d'insecticide a été de 1,65 mg/g substance verte en pépinière, contre 0,24 mg/g en pots. Il en résulte que, dans les conditions de terrain, les plants de peuplier Robusta de 2 ans, pendant le temps sec, peuvent mobiliser le Dipterex administré en solution

aqueuse à raison de 9,3% de la quantité versée dans le sol, contre 1,35% dans les expériences en laboratoire. L'administration des solutions sur les feuilles par pulvérisation a un rendement faible d'absorption de l'insecticide, grâce aussi bien au mécanisme difficile d'absorption des feuilles qu'au lavage de l'insecticide par l'eau de pluie, la rosée et le brouillard. On a décelé une grande quantité d'insecticide sur le sol; c'est pourquoi les auteurs considèrent que la méthode d'administration des solutions d'insecticides systémiques dans le sol doit être adoptée en priorité dans la lutte contre les ennemis des essences ligneuses. (From auth.)

II-G-3-h RICE

698 Ishii, S., Hirano, C. TRANSLOCATION OF γ-BHC IN RICE PLANT CULTURED IN AQUEOUS SOLUTION OF C^{14}-γ-BHC. Jap. J. appl. Ent. Zool. 6, 1 (1962) 28-33. (In Japanese, with English summary).

It has been confirmed that 1st brood larvae of the rice stem borer, Chilo suppressalis Walker, can be killed when γ-BHC is applied to the paddy field soil before transplanting rice seedlings. In order to establish the translocation route to the borer zone, γ-BHC-1-C^{14} (9.4 mg at 0.4 μc/mg to 1 litre of water) was used in culture solutions (final concentration < 9.4 ppm). Rice seedlings of about 40-50 cm in height were cultured in water for 1 week, to develop new roots. After immersion of the roots in culture solution for 65 or 119 h, the treated seedlings were exposed on X-ray film for about 3 months. Autoradiograms show that γ BHC is absorbed from the roots and translocated to stems and leaves through vascular bundles. In other experiments absorbant cotton soaked with vaseline was applied to the stem to check on capillary creeping, once the roots were immersed in the radioactive solution. Paper chromatography and gas flow counters were used for assaying. Results indicate that γ-BHC dissolved in water is not only absorbed and translocated to stems and leaves but also creeps up over the surface of leaf sheaths by capillary action. For γ-BHC applied to irrigation water from the surface the main route of translocation appears to be via the leaf sheath surfaces.

699 Tomizawa, C., Sato, T. METABOLIC FATE OF MALATHION AND METHYL PARATHION IN RICE PLANT. Jap. J. appl Ent. Zool. 6, 1 (1962) 70-5. (In English).

The metabolic fate of S^{35}-labelled malathion and methyl parathion, sprayed on rice plants, was examined. When the metabolic rate of the insecticides was examined by the partition ratio of the insecticide metabolites between chloroform and trichloroacetic acid in aqueous solution, the greater part of the insecticide metabolites contained in rice grains was water-extractable even 1 week after spraying. The water extracts of the insecticide metabolites in rice grains were subjected to ion exchange chromatography, and the existence of several hydrolysis products was confirmed for both malathion and methyl parathion. The main metabolites were thiophosphoric acid malathion, and thiophosphoric acid, O,O-dimethyl thiophosphoric acid and O-p-nitrophenyl thiophosphoric acid for methyl parathion.

II-G-3-j TEA AND CABBAGE

700 Tomizawa, C. Fukuda, H. Masuda, T., Miyahara, Y. FATE OF O,O-DIMETHYL O-(3-METHYL-4-METHYLMERCAPTOPHENYL) THIOPHOSPHATE SPRAYED ON TEA AND CABBAGE LEAVES. Jap J. appl. Ent. Zool. 6, 3 (1962) 237-41. (In English, with Japanese summary).

Fenthion (Baycid) labelled with P^{32} was used to study the behaviour of the compound in tea and cabbage leaves. Penetration and metabolism appeared to be more rapid in the cabbage. The PS-sulphoxide and PS-sulphone were the principal metabolites in the tea leaves, and other chloroform-extractible products were scarce. The results for cabbage were not the same, and the appearance of a metabolite suggesting oxidation to the corresponding phosphate was observed. The amounts and distribution of the metabolites in green tea were little altered by the process of manufacture. (RAE-A 52: 1964, 301).

II-G-3-k SUGAR CANE

See 686

II - G - 3 - 1 METABOLIC EFFECTS OF INSECTICIDES ON (labelled) PLANTS (wheat, potatoes, apple trees)

701 Богдарина, А.А., Зазерина, А.Н. О ПОСТУПЛЕНИИ ФОСФОРА (P^{32}) И АЗОТА В РАСТЕНИЕ ПРИ ПРИМЕНЕНИИ ХЛОРОРГАНИЧЕСКИХ ИНСЕКТИЦИДОВ. Стр. 40-2 в сб. "Материалы Симпозиума по применению биофизики в области защиты растений". Л. 1961. Р. Ж. Биол. №17Г70. 1962.

Bogdarina, A.A., Zazerina, A.N. ASSIMILATION OF PHOSPHORUS (P^{32}) AND NITROGEN BY PLANTS TREATED WITH CHLORINATED ORGANIC INSECTICIDES. p.40-2 in "Materials of the Symposium on the Use of Biophysics in the Field of Plant Protection". Leningrad, 1961. R. Zh. Biol. No. 17G70. 1962.

The effect of varying doses of hexachloran and DDT on the assimilation of P^{32} by plants was studied on wheat, potatoes, and apple trees. The exposure was for 3.5 h and 2-10 d. The characteristics of P absorption by plants were intimately related to the nature of insecticide action and to the duration of exposure of the plants to the poisons and environmental conditions. By using stimulating doses of the preparations P assimilation was accelerated and 1.5-2-fold more P^{32} accumulated in treated plants than accumulated in those untreated. Inhibiting doses of the insecticides caused a decrease in assimilation and accumulation of P^{32} within 3 d. Phytocidal doses suppressed P^{32} absorption for a long period. Combined use of insecticides and P accelerated N absorption. Efficient use of insecticides in combination with fertilizers protects the plants from harmful organisms and increases yield. (CA 58: 1963, 10518a)

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See also:

508 The metabolism of hydrocyanic acid. (Tschiersch, 1963)
510 Studies on the mechanism of fumigants. (Jap. Food Research Inst. Tokyo, 1962)
518 The absorption of sulphur dioxide by fir trees. (Materna and Kohout, 1963)
519 The spatial distribution of S^{35} and the identity of the tagged compounds in leaves of spinach after treatment with $S^{35}O_2$ gas. (Weigl and Ziegler, 1962)
526 Syntheses and studies on some C^{14}-labelled insecticides belonging to the halogenated hydrocarbons and on labelled iridomyrmecin. (Korte et al., 1962)
529 Microsyntheses of C^{14}-labelled insecticides and some biochemical studies. (Rechmeier, 1962)
536 Systemic nature of γ-BHC in plants. Mode of action of BHC. II. (Ishii et al., 1959)
541 Girdling experiments on the translocation of topically applied radioactive γ-benzene hexachloride-C^{14} in certain woody plant with insect galls. (Torii, 1961)
551 Fate of O,O-dimethyl O-(3-methyl-4-methylmercaptophenyl) thiophosphate sprayed on rice plants. (Fukuda et al., 1962)
554 Metabolism of radiolabeled 3-(dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide (Bidrin, SD 3562) in beans and mammals. (Menzer, 1963)
558 Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment]. I. Penetration and translocation of Rogor P^{32} applied to the trunk of the lemon tree. (Pietri-Tonelli and Barontini, 1961)
559 Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment] II. Penetration and translocation of P^{32}-labelled Rogor sprayed on crops. (Pietri-Tonelli and Barontini, 1961)
560 Behaviour of P^{32}-labelled Rogor applied to plants [by spray treatment]. III. Penetration and translocation of P^{32}-labelled Rogor applied by spraying herbacious plants and trees. (Pietri-Tonelli and Barontini, 1961)
562 Systemic migration and insecticidal activity of dimethoate applied on tree trunks. (Pietro-Tonelli et al., 1961)
563 Penetration, translocation and metabolism of P^{32}-labelled Rogor applied to the trunk of the lemon tree. (Santi, 1961)
564 Metabolic fate of P^{32}-labelled dimethoate in olive fruits and some toxicological implications. (Santi and Giacomelli, 1962)
565 Study on the metabolism of P^{32}-labelled Rogor in sugar and fodder beet. (Santi et al., 1962)
566 Penetration, translation, and metabolism of Rogor-^{32}P applied on lemon tree trunks. (Santi, 1961)
569 Chemical and biological behavior of fenthion residues. (Metcalf et al., 1963)
570 On the occurrence of biologically active metabolites of the active ingredient S 1752 after application of LEBAYCID®. (Niessen, 1962)
571 Distribution of aerially applied malathion-S^{35} in a forest ecosystem. (Giles and Peterle, 1963)

576 The synthesis of phosphamidon and its decomposition in plants. (Anliker et al., 1961)
584 Studies on the mode of action of organophosphorus compounds. Part I. Metabolic fate of P^{32}-labelled Sumithion and methyl parathion in guinea pig and white rat. (Miyamoto et al., 1963)
585 Penetration and translocation of a systemic insecticide. (Costa et al., 1963)
590 Radioactive-labelled phosphoric acid esters. I. Preparation of P^{32}-labelled isomers of the β-methylmercaptoethyl thiophosphoric dimethyl ester and their hydrolytic breakdown in the plant. (Dedek et al., 1962)
595 Radical absorption of P^{32}-labelled O,O-dimethyl-S-benzene sulfonyl phosphorodithioate. (Fontana and Silva, 1963)
609 Non-hydrolytic pathway in metabolism of Sevin. (Dorough and Casida, 1963)
619 Metabolism of radio-labeled SD-3562 in insects and cotton leaves. (Bull and Lindquist, 1962)
632 Absorption and metabolism of dimethoate in the bollworm and boll weevil. (Bull et al., 1963)
661 Metabolism of O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate by white rats. (Brady and Arthur, 1961)
682 Metabolism of 2,2-dichlorovinyl dimethyl phosphate in relation to residues in milk and mammalian tissues. (Casida et al., 1962)
725 Locale and metabolism of methyl parathion and Guthion in the cotton leaf. (Shipp, 1963)

II-H Insecticide Residues in

II-H-1 ANIMALS AND ANIMAL PRODUCTS

II-H-1-a GENERAL

702 Haller, H.L. THE USE OF ATOMIC ENERGY TO STUDY AGRICULTURAL CHEMICAL RESIDUES. p.147-60 in "Applications of Radioisotopes and Radiation in the Life Sciences 1961". Hearings before the Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy, Congress of the United States. 87th Congress, 1st Session, 27-30 March 1961.

Review article on applications of radioisotopes to pesticides. The usefulness of labelling for studying their structure and mode of action is discussed, and particular stress laid on their role in residue determinations.

See also:

567 Metabolism of systemic and other recent insecticides in animals. (Arthur, 1962)
658 Use of radioisotopes in studying the absorption, distribution and elimination of certain insecticides in animals. (Filatov et al., 1963)
1549 Instrumentation in pesticide residue determinations. (Gunther, 1962)
711 Polymer-insecticide systems as livestock feed additives. (Abstr.283). (Lloyd and Matthysse, 1963)
717 Some problems in the determination of residues in plants and mammals. (Heath, 1963)

II-H-1-b SHEEP

703 Baurledel, W.R., Swank, M.G. RESIDUE AND METABOLISM OF RADIOACTIVE 4-tert-BUTYL-2-CHLOROPHENYL METHYL METHYLPHOSPHORAMIDATE ADMINISTERED AS A SINGLE ORAL DOSE TO SHEEP. J. agric. Food Chem. 10 (1962) 150-4.

Sheep were given single oral doses of P^{32}-labelled Ruelene (weighed into gelatin capsules and administered with a balling gun). The metabolic fate was studied, and the residue in the tissues was determined for periods up to 21 d post-treatment. Ruelene and several hydrolysis products were found in the blood shortly after treatment, but by 2 d the Ruelene had decreased to a low level. Over 86% of the administered P^{32} was recovered in the excreta. The P^{32} in the urine, amounting to 75% of the dose, was primarily in the form of hydrolysis products of Ruelene. Some of the Ruelene was hydrolyzed completely to inorganic phosphate and retained in the animal tissues, in part as natural phosphate esters and in part as inorganic phosphate. Ruelene itself was not found in the tissues after 7 d.

704* Cutkomp, L.K. PESTICIDES RESIDUES. USE OF RADIOACTIVE TRACER METHOD TO DETERMINE POSSIBLE RESIDUES IN MILK AND MEAT FROM DAIRY COWS. Paper No.1727. Miscellaneous Journal Series, Minnesota Agricultural Experiment Station, St. Paul. 6p. 1960.

The suitability of the isotope dilution method for such residue determinations is discussed. The method is illustrated for C^{14}-labelled methoxychlor in milk. It is suggested that such techniques might be profitably incorporated in early toxicological studies on rats before using cows.
(Paper presented during 46th midyear meeting, Chemical Specialities Manufacturers Association, Chicago, 17 May 1960).

705 Roberts, R.H., Chamberlain, W.F. FACTORS CONTRIBUTION TO THE LOSS OF INSECTICIDE DEPOSITS ON CATTLE. J. econ. Ent. 56, 5 (1963) 614-8.

Comparisons of photographs taken at various times after spraying whitewash on cattle, bioassays of selected areas on cattle sprayed with DDT and methoxychlor, and radiometric measurements of hair and urine taken during and after confinement from a steer sprayed with C^{14}-labelled DDT, showed that most of the loss of dermal treatments from an animal's body could be accounted for by the abrasive action of the tail, contact with ground, rubbing and other exercise, rain, and licking. (Auth.)

706 Kartashova, V.M., Kartashov, P.A. DETERMINATION OF RESIDUES OF TOXIC PRINCIPLES IN MILK AND MEAT BY THE USE OF RADIOACTIVE INDICATORS. p.105-6 in "Radioaktivnye, Izotopy i Yadernye Izluchenia v Narodnom Khozyaistve SSSR. Trudy Vsesoyuznogo Soveshchaniya, Riga, 1950". 1961. (In Russian).

The uptake of DDT and hexachlorocyclohexane (I) labelled with C^{14} and Cl^{36}, respectively, by the cow through the skin, the outflow of radioactivity after loading, and toxicity of milk containing I were studied. A cow was sprayed with DDT in oil in 2 doses of 30 and 23.9 mc C^{14}/kg body weight at interval of 135 d and sacrificed on the 45th day after the 2nd spraying. It resulted in secretion into the milk of 3.22-82 mg of DDT within the first 10 d. In urine and faeces 2/3 of DDT was excreted and 80% of DDT in milk remained unchanged. DDT was deposited in all parts of the animal body. A 2nd cow treated with 8 applications of 1 l each of an aqueous mineral-oil emulsion containing 2% I, at intervals of 3 d gave milk containing the following amounts (I/l of milk): 1st treatment 19 mg after 6 h, 8th treatment 148 and 216 mg after 6 and 24-48 h, respectively. I was secreted in the milk in appreciable quantities for at least 2 months after treatment was discontinued. Kittens fed 150-200 g of this milk daily became moribund, developed twitching of limbs, and finally died after 7-11 d. (CA 56: 1962, 6420h).

707 Roberts, R.H., Claborn, H.V., Radeleff, R.D. RESIDUES IN THE MILK OF DAIRY COWS SPRAYED WITH P^{32}-LABELED GENERAL CHEMICAL 4072. J. econ. Ent. 54, 5 (1961) 1053-4.

An alkylated aryl polyether alcohol, General Chemical 4072 (2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate) was labelled with P^{32}. Samples were used to study the secretion of the compound in the milk following applications to two dairy cows. A table lists the amount of milk produced, percentage of butterfat, and ppm of organosoluble residue in milk of treated cows. Data indicate that absorption, as determined by the secretion levels, is greater when the spray is brought into contact with the skin.

708 Timmerman, J.A., Jr., Buttram, J.R., Dorough, H.W., Arthur, B.W. IN VITRO STABILITY AND RECOVERY OF INSECTICIDES FROM MILK. J. econ. Ent. 54, 3 (1961) 441-4.

Extraction techniques used are described. Aliquots of the acetonitrile, n-hexane, water, and milk residue were assayed for total radioactivity. The P^{32}-labelled Co-Ral, Ruelene®, Bayer 29493, and Bayer 22408 were assayed with an end-window GM-tube; the analysis of C^{14}-labelled DDT and Cl^{36}-labelled Kepone®, and dieldrin were made with a windowless gas-flow counter according to radiometric procedure described previously*. The percentage recovery of these insecticides from milk was based on the amount of radioactivity appearing in the final acetonitrile fraction from 4 separate determinations. Recoveries of Sevin® (1-naphthyl N-methylcarbamate), Kepone® (decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd] pentalen-2one), Bayer 29493 (O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate), Bayer 22408 (O-naphthalimido-O,O-diethyl phosphorothioate), Ruelene® (O,4-tert-butyl-2-chlorophenyl O-methyl methylphosphoramidate), and CoRal® (O,O-diethyl O-(3-chloro-4-methylumbelliferone) phosphorothioate) from milk ranged from 87% to 97% using acetonitrile and chloroform as the primary extraction solvents and acetonitrile-n-hexane as a cleanup procedure. This extraction procedure was somewhat less effective for

* J. econ. Ent. 53: 1960, 848.

Thirty White Leghorn hens were dusted with P^{32}-labelled Co-Ral® (O,O-diethyl O-(3-chloro-4-methyl-umbelliferone) phosphorothioate or Bayer 21/199) at 50 mg/kg. Twenty hens were dusted once, while 10 hens received 2 applications at weekly intervals. Some intact Co-Ral remained on the feathers and skin for 28 d after treatment. The liver, kidney, and bone contained more radioactivity than other internal tissues. By 3 d after treatment, acetonitrile-soluble residues in internal tissues were negligible. The eggs contained minute quantities of aceto-nitrile-soluble residues at 5 to 7 d after treatment of the hens, but these residues were not characterized as Co-Ral or its oxygen analog. Radioactive materials excreted in the faeces consisted of residual Co-Ral, the oxygen analog, O,O-diethyl phosphoric and O,O-diethyl phosphorothioic acids. Phospholipids, ribose nucleic acid, desoxyribose nucleic acid and acid-soluble phosphorus compounds were isolated from the liver and faeces. (Auth.)

714 Dorough, H.W., Brady, U.E. Jr., Timmerman, J.A. Jr., Arthur, B.W. RESIDUES IN TISSUES AND EGGS OF POULTRY RECEIVING CO-RAL(BAYER 21/199) IN THE FEED. J. econ. Ent. 54, 1 (1961) 97-100.

P^{32}-labelled Co-Ral® was mixed in laying mash at 100 ppm and fed to laying hens for a max. of 7 d. The highest concentration of total radioactive residues was in the liver and kidney; deposition of Co-Ral or metabolites in the fat was minor. The liver, kidney, and gizzard contained the highest concentration of acetonitrile-soluble materials. Acetonitrile-soluble residues were not present in any tissue after the hens were returned to normal feed for 7 d. Small but detectable amounts of acetonitrile-soluble materials were present in egg yolks analyzed at 11 to 15 d after treatment, but none was present in the albumin. About 79% of the radioactivity consumed in the feed was excreted in the faeces by 28 d posttreatment; more than 85% of the excreted radioactive materials were hydrolytic products. Unchanged Co-Ral, the oxygen analog of Co-Ral(O,O-diethyl phosphoric acid) and O,O-diethyl phosphorothioic acid were isolated and characterized from the faeces. (From auth.)

715 Dorough, H.W., Arthur, B.W. DISTRIBUTION AND SOLUBILITY PROPERTIES OF PHOSPHORIC AND O,O-DIETHYL PHOSPHORODITHIOIC ACIDS FED TO LAYING HENS. J. econ. Ent. 54, 6 (1961) 1140-3.

P^{32}-labelled phosphoric acid and O,O-diethyl phosphorodithioic acid were fed at 100 ppm in the diet of laying hens for 7 d. The liver, kidney, and bone accumulated more radioactive materials than the blood, brain, breast, fat, feathers, gizzard, or skin. Egg yolk contained more acid equivalents than the shell or white. Acetonitrile-soluble residues were detectable in the faeces, egg yolk, and liver. About 46% of the phosphoric acid and 36% of the diethyl phosphorodithioic acid consumed in the feed were present in the faeces 14 d after treatment of hens. The phosphoric acid and diethyl phosphorodithioic acid exhibited solubility properties characteristic of many organophosphate insecticides. (Auth.)

II-H-1-f MAN

716 Fredriksson, T. PERCUTANEOUS ABSORPTION OF PARATHION AND PARAOXON. IV. DECONTAMINATION OF HUMAN SKIN FROM PARATHION. Arch. envir. Hlth 3 (1961) 185-8.

The efficiency of a decontamination procedure for removing P^{32}-labelled parathion (E 605, diethyl 4-nitrophenyl thionophosphate) from the skin surface of human volunteers was tested. Two series of experiments, each using 4 men, were performed, the material being left on the skin for 30 and 300 min, respectively. The radioactivity was determined before and after the cleansing procedure, and the residue calculated as percentage of the initial count after substraction of the background count. After ordinary washing with soap and water for 30 sec a residue of ~30-50% and 8-20% for the long-term and short-term groups, respectively, remained. An alcohol wash immediately after the initial cleansing still left a considerable residue (> 10% and ~5%, respectively). A final cleansing with soap and water left a residue of > 5% in the long-term series, the skin being almost completely decontaminated for the other. The theoretical aspects of the time factor involved are discussed and the practical implications within the field of occupational medicine stressed. (From auth. summary)

See also:

676 The metabolism of orally administered malathion by a lactating cow. (O'Brien et al., 1961)

678 Studies on the percutaneous absorption of parathion and para-oxon. II. Distribution of ^{32}P-labelled parathion within the skin. (Fredriksson and Bigelow, 1961)

679 Tissue distribution of P^{32}-labeled parathion. Autoradiographic technique. (Fredriksson and Bigelow, 1961)

671 Detection and distribution of ^{32}P labelled diazinon in dog tissues after oral administration. (Millar, 1963)

673 The metabolism of P^{32}-labeled dimethoate in sheep. (Chamberlain et al., 1961)

662 Absorption and metabolism of Bayer 22408 by dairy cows and residues in the milk. (Buttram and Arthur, 1961)

667 A study of the absorption of ^{14}C-labelled DDT from water by fish. (Holden, 1962)

592 Radioactive-labelled phosphoric acid esters. III. The fate of P^{32}-labelled Wotexit following intravenous or intramuscular injection in cattle. (Dedek and Kühnert, 1962)

659 Metabolism of radio-labelled systemic insecticides in animals. (Weidhaas et al., 1962)

578 Toxicological studies of organophosphate anthelmintics. (Timmerman, 1963)

590 Radioactive-labelled phosphoric acid esters. I. Preparation of P^{32}-labelled isomers of the β-methylmercaptoethyl thiophosphoric dimethyl ester and their hydrolytic breakdown in the plant.

II-H-2 INSECTICIDE RESIDUES IN PLANTS AND PLANT PRODUCTS

II-H-2-a GENERAL

717 Heath, D.F. SOME PROBLEMS IN THE DETERMINATION OF RESIDUES IN PLANTS AND MAMMALS. p.185-92 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Chemical and biochemical methods of residue determination assume that the nature of the toxic compounds present is known, and that they can be extracted in known yields. Neither assumption is easily validated except by using radioisotopes. The use of radioisotopes to investigate these problems is described, with examples taken from work on demeton and dimefox (P^{32}) and the fungicide triphenyltin acetate (Sn^{113}).

718 Adams, J.M., Anderson, C.A., McDougall, D. THE DETECTION OF RESIDUES OF SYSTOX AND ITS TOXIC METABOLITES IN THE PRESENCE OF OTHER ORGANOPHOSPHORUS PESTICIDES. J. agric. Food Chem. 11 (1963) 178-80.

A method has been developed for detection of residues of Systox and its metabolites in plants. The method is based upon chromatographic separation on paper and subsequent characterization through the use of the colour forming agent, 2,6-dibromo-N-chloro-p-quinoneimine. Recovery data were obtained using P^{32}-labelled compounds. The radioactivity was measured on paper chromatograms with a strip counter. In 11 of the 20 cases recoveries were ≥75%, in 7 ~50-75%, and only in 2 < 50%. Even considering the low recoveries obtained in a few cases, the method is still capable of detecting 0.3 ppm of the Systox thiol isomer or the sulfoxide or sulfone of either isomer. The thiono isomer sulfone was not included in this recovery experiment as radio-labelled material was not available. The method will distinguish residues of Systox and its metabolites in the presence of other organophosphorus pesticides and cholinesterase inhibitors. With the application of a preliminary chromatographic cleanup procedure, the method has been used for the detection of Systox residues in a large number of crops.

719 Danbara, H., Tomizawa, C. ELIMINATION OF RESIDUAL AGRICULTURAL CHEMICALS. II. CONTAMINATION WITH BAYCID (O,O-DIETHYL O-(3-METHYL-4-METHYLTHIOPHENYL) THIOPHOSPHATE). Igaku to Seibut. 59, 5 (1961) 145-7.

A tendency similar to methyl parathion was observed with P^{32}-labelled Baycid. (CA 60: 1964, 4714f).

720 Phillips, F.T. THE APPLICATION AND MEASUREMENT OF LABELLED RESIDUAL INSECTICIDES IN SOME PHYSICO-CHEMICAL STUDIES. p.147-52 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

The disappearance of residual films of insecticides from plant and other surfaces may be conveniently studied if the insecticide is labelled with a radioisotope of sufficient radiant energy to allow for a simple measuring technique. Methods of application of insecticide solutions on different surfaces led to the design of a spray chamber suitable for the distribution of very small amounts (a few drops) of radioactive liquid formulations over a 35-cm^2 circular area. Some measurements of the rates of volatilization of Cl^{36}-labelled dieldrin and aldrin crystals from glass surfaces are included. (Auth.)

II-H-2-b APPLE

721 Bazzi, B., Santi, R., Canale, G., Radice, M. METODI DI MICRODOSAGGIO DEI RESIDUI DI CIDIAL® (ESTERE ETILICO DELL' ACIDO O,O-DIMETILDITIOFOSFORILFENILACETICO) NEI PRODOTTI AGRARI. DETERMINAZIONE NELLE MELE PER VIA COLORIMETRICA IN BASE AL P E PER VIA CROMATOGRAFICA SU STRATO SOTTILE. (Determination of microdosages of Cidial® (ethyl ester of O,O-dimethyldithiophosphoryl-1 phenylacetic acid) in agricultural products. Determination in apples by means of colorimetry based on P by chromatography of thin layer). Italy, Istituto di Ricerche Agrarie, Montecatini, Società Generale per l'Industria Mineraria e Chimica - Milano. 1963. n.p. (In Italian, with English, French and German summaries).

A colorimetric method for residue determination is described for Cidial which is employed in the control of Carpocapsa pomonella L. in apples. The procedure involves (a) extraction, with proper solvents, of the insecticide from the oil; (b) separation from water-soluble insecticides (e.g. Rogor) eventually employed with Cidial in order to control other insects; (c) clean-up of the active ingredient by microdistillation or chromatography from the interfering P compounds; (d) analysis based on P colorimetric determination. P^{32}-labelled ethyl ester of O,O-dimethyldithiophosphoryl-8 phenylacetic acid and of its P=O analogue, were used. Details of the thin layer chromatographic method used are given. 0.1 ppm of active ingredient may be estimated with the colorimetric method, 0.3 ppm with the chromatographic one.

II-H-2-c BANANA

722 Bowman, J.S., Gaudiz, I., Robbins, A.J. THE USE OF CARBON-14-LABELED MATERIALS AS AN AID IN THE DEVELOPMENT AND UNDERSTANDING OF PESTICIDE CHEMICAL ANALYTICAL TECHNIQUES. 140th Amer. Chem. Soc. Meeting, Chicago, 3-8 Sep. 1961. Paper 31.

By using C^{14}-Zinophos* it was possible to perform a materials balance study on banana extracts and establish the fact that poor recoveries were not due to loss of material but to the presence of interfering agents which inhibited fluorescence measurement. (Cited on p.41 in "Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives. Vol.I. Principles, Methods, and General Application". Zweig, G., Ed. New York, Academic Press. 1963).

* O,O-diethyl O-2-pyrazinyl phosphorothioate

II-H-2-d BEANS AND TURNIPS

723 Frehse, H., Niessen, H., Tietz, H. METHODE ZUR BESTIMMUNG VON RÜCKSTÄNDEN DES INSEKTIZIDS LEBAYCID® IN PFLANZLICHEM MATERIAL. (Method of determining residues of the insecticide Lebaycid® in plant material). Leverkusen, Hofchenbr. Bayer PflSchutz-Nachr. 15, 3 (1963) 152-63. (In German).

A procedure is described in detail which allows residue detection (< 0.1 ppm) of the active principle of Lebaycid (fenthion), O,O-dimethyl-O-(methylmercaptophenyl-)thiophosphate (or S 1752, mercaptophos or Bayer 29493), and of its metabolites to be detected in plant tissue. Plant extracts were purified with organic solvents and columns of aluminium oxide or activated charcoal. For a quantitative determination two methods are available, which may be used independently or consecutively: (1) infrared absorption (~7.55 μ) of the S bands obtained from oxidation, and (2) colorimetric microdetermination of P from wet ash. The yield is 80%, and is specific for S 1752-residues which can be identified through infrared absorption in the range from 7-11 μ. P^{32} was used in the necessary quantitative experiments for analyzing residues in beans and turnips.

II-H-2-e COTTON

724 Hacskaylo, J., Lindquist, D.A., Davich, T.B., Morton, H.L. ACCUMULATION OF PHORATE BY COTTON PLANTS FROM SOLUTION AND SAND CULTURE. Bot. Gaz. 123 (1961) 46-50.

Cotton seedlings were grown in a nutrient solution containing P^{32}-labelled phorate (O,O-diethyl S-(ethylthio)methyl phosphorodithioate (I). The latter accumulated rapidly in the roots at first (3-4 d) but

declined sharply later (7 d). Loss of I from leaves occurred passively via roots into the nutrient solution. Translocation of I from roots to leaves increased with the respiration rate. Subsequent root exposure did not, however, cause additional absorption of insecticide by the plant but, on the contrary, a leakage from roots to nutrient solution. The accumulation of I in leaves of plants grown in sand culture was linearly related to time and was positively affected by conditions favouring transpiration.

725 Shirr, O.E. LOCALE AND METABOLISM OF METHYL PARATHION AND GUTHION IN THE COTTON LEAF. (Abstr. 54). Bull. ent. Soc. Amer. 9, 3 (1963) 163.

The locale of residues of methyl parathion and Guthion on leaves of field cotton was ascertained. Using potted cotton treated with P^{32} labelled methyl parathion or Guthion the phosphorus containing metabolites were determined by radioautographic techniques from benzene or chloroform extracts of the treated leaves.

726 Shipp, O.E., Lindquist, D.A., Brazzel, J.R. CHARACTERISTICS OF RESIDUES OF METHYL PARATHION APPLIED TO FIELD COTTON. J. econ. Ent. 56, 6 (1963) 793-8.

Methyl parathion applied to field cotton by a high-clearance spray machine at the rate of 0.5 lb in 6 gal of water per acre was found to persist on and in the foliage up to 12 d. The principal site of the residues of the insecticide was in and under the cuticle of the leaf and not on the surface. Bioassays indicated the residues of methyl parathion found 1, 3, 7, and 12 d after treatment of the cotton were toxic to the boll weevil (Anthonomus grandis Boheman). Analyses using P^{32}- labelled methyl parathion indicated the residual half-life of the insecticide applied to cotton leaves was approximately 24 h. Maximum penetration of the leaf by the insecticide occurred within the first 2 h after application. The P^{32}-labelled methyl parathion was not translocated from its site of application on the cotton leaf. Locale analyses using radioactive methyl parathion indicated that most of the residual deposit was located within the leaf tissues, with some remaining in the cuticular layer of the leaf. Four compounds containing P^{32} were found in the residue. Two were identified as methyl parathion and methyl para-oxon (dimethyl p-nitrophenyl phosphate) and the others were not identified. Under conditions of high temperatures (72° to 112°F) more of the residual methyl parathion in the cotton leaf was converted to methyl para-oxon than under conditions of lower temperatures (70° to 90° F). The toxicity of the residues of methyl parathion over extended periods was due in part to the presence of methyl para-oxon. (Auth.)

II-H-2-f OLIVE

727 Bazzi, B. DOSAGGIO DEI RESIDUI DI N-MONOMETILAMMIDE DELL'ACIDO O,O-DIMETILDITIOFOSFORILACETICO (ROGOR) IN OLIVE E ORGANI VEGETALI DIVERSI. (Residue determinations in olives and various parts of plants of the N-monomethylamide of O,O-dimethyldithiophosphoryl acetic acid (Rogor)). Italy. Istituto di Ricerche Agrarie. Laboratorio di Signa, Firenze, Montecatini Società Generale per l'Industria Mineraria e Chimica - Milano, 1960, p.3-18. (In Italian, with English, French, and German summaries).

A method is described for the chemical microdetermination in olive fruit of Rogor [S-(methylcarbamyl) methyl-O,O-dimethyldithiophosphate) in the control of the olive fruit fly. The method involves 2 procedures whose adoption depends on the ratio in the extract between the quantity of oily residue and of insecticide. The ratio varies with the physiological stage of the drupes at the moment of analysis and with the operative conditions at the time of insecticide application. The first procedure permits 0.4 ppm determinations of active ingredient, the second 0.05 ppm. The reliability of the latter was established by isotopic dilution technique, using P^{32}-Rogor. Chromatographic, biological and spectrophotometric infra red studies were also carried out on purified extracts.

728 Bazzi, B. DETERMINAZIONE DEI RESIDUI DELL'ESTERE ETILICO DELL'ACIDO O,O-DIETILDITIOFOSFORILACETICO (CIDIAL) NEI PRODOTTI AGRARI. (Determination of residues of the ethyl ester of O,O-dithiophosphorylacetic acid [Cidial] in agricultural products). Chimica 39, 5 (1963) 283-8. (In Italian).

729 Bazzi, B. CONTRIBUTO DELL'ISTITUTO DI RICERCHE AGRARIE DELLA SOC. MONTECATINI ALLA CONOSCENZA DEL METABOLISMO DEGLI ESTERI FOSFORICI INSETTICIDI NEGLI ORGANISMI VEGETALI ED ALLA VALUTAZIONE DEI RESIDUI. (The Agricultural Research Institute of the Society of Montecatini: Data on phosphoric ester insecticides in plants and residue evaluations). Italy. Istituto di Ricerche Agrarie. Montecatini, Società Generale per l'Industria Mineraria e Chimica - Milano, 1963. p.3-23. (In Italian)

The work of the Institute is reviewed, particularly on parathion. Rogor and Fac. P^{32}-labelled Rogor was used for studying its metabolism in olives. Methods and results are summarized. The relation between the enzymatic activity of the fruit and the velocity with which Rogor concentration drops are discussed. The P=O derivative formed is more toxic than Rogor and less than parathion. It is formed shortly after administration, rises to a maximum, and then drops gradually. Hydrolysis leads to water-soluble acid compounds, concentration increasing with increasing Rogor degradation. Concentration in oil, and toxicity to mice and rats are discussed. A series of tables deal with such topics as LD_{50} for rats and mice, and the persistence of Rogor and derivatives in (oil) olives from treated trees, oil, (eating) olives, sugar beet, beets, cherries, and peaches.

730 Frehse, H., Niessen, H., Tietz, H. METHODE ZUR BESTIMMUNG VON RÜCKSTÄNDEN DES INSEKTIZIDS LEBAYCID® IN OLIVEN UND OLIVENÖL. (Method of determining residues of the insecticide Lebaycid® in olives and olive oil). Leverkusen Höfchenbr. Bayer PflSchutz-Nachr. 15, 3 (1963) 164-9. (In German).

An extraction process using P^{32}, already utilized in 1959, was further developed in the autumn of 1961. Details of a method are given by which residues of Lebaycid may be determined in olives and olive oil. Residues are enriched, followed by separation from the naturally occurring P-containing compounds in the olive, and the P contained in the molecule of the active principle is subsequently determined by a colorimetric microtechnique.

II-H-2-g SPINACH

731* Klein, A.K., Lang, E.P., Sheehan, J.D., Jr. EXTRACTION PROCEDURES FOR CHLORO-ORGANIC INSECTICIDES. J. Ass. off. agric. Chem., Wash. 42 (1959) 539-44.

In a study in which 3 different sample extraction procedures were compared, C^{14}-methoxychlor was sprayed on spinach plants to determine efficiency of extraction. (Cited on p.41 in "Analytical Methods for Pesticides, Plant Growth Regulators, and Food Additives. Vol.I: Principles, Methods, and General Application". Zweig, G. Ed. New York, Academic Press, 1963).

II-H-2-h WHEAT

732 Lindgren, D.L., Vincent, L.E., Gunther, F.A. BROMINE RESIDUES IN WHEAT AND MILLED WHEAT FRACTIONS FUMIGATED WITH METHYL BROMIDE. J. econ. Ent. 55, 5 (1962) 773-6.

Bromine residues in fumigated wheat and wheat products were analyzed as total inorganic plus organic bromine by instrumental neutron activation analysis. Irradiations were performed in a Triga nuclear reactor: each 5 g sample of wheat was neutron-irradiated for 30 min at a neutron flux of 1.8×10^{12} neutrons/cm^2-sec at a power level of 250 kW; after a 2- to 4-d decay period X-ray spectra were taken with multichannel analyzers. Concentrations of Br in the wheat were calculated by comparing intensities of the 0.77 MeV γ-ray peaks of 36-h Br^{82} in the spectra of the activated samples with those of irradiated Br reference standards. Very little or no loss of Br occurred after aeration for 8 h with either 9% or 15% moisture content wheat. A greater increase in the Br residue occurred with an increase in the moisture content of the wheat or in fumigation temperature. Results indicate that fumigation at lower temperatures and higher dosages may result in lower Br residues than fumigation at higher temperatures and lower dosages. The residue found in wheat fumigated for 48 h was more than 8 x greater than for wheat fumigated for 2 h. A repeat fumigation following a first fumigation by 24 h added 60-70% more Br residue. Regardless of whether the wheat is fumigated and then milled to obtain fractions or whether the fractions are fumigated after milling, the amount of Br residue found was in the following sequence: bran > shorts > flour > middlings.

See also:

510 Studies on the mechanism of fumigants. (Japan. Food Research Inst. Tokyo, 1962)
511 The residue potential of sulfuryl fluoride, methyl bromide, and methane-sulfonyl fluoride in structural fumigations. (Meikle and Stewart, 1962)
519 The spatial distribution of S^{35} and the identity of the tagged compounds in leaves of spinach after treatment with $S^{35}O_2$ gas. (Weigl and Ziegler, 1962)
537 Effect of chlorinated terphenyl on evaporation of γ-BHC. Mode of action of BHC. III. (Ishii and Matsuda, 1959)

552 Residual behavior of O,O-dimethyl S-isopropyl-2-sulfinylethyl phosphorothiolate and its analogues in plants. (Tomizawa, 1963)

564 Metabolic fate of P^{32}-labeled dimethoate in olive fruits and some toxicological implications. (Santi and Giacomelli, 1962)

687 Phorate accumulation by cotton plants and recovery from soil. (Hacskaylo et al., 1961)
Evolution des dépôts superficiels, diffusion et dégradation de deux insecticides endothérapiques: le déméton-S et l'endothion dans quelques plantes marafchères. (Hascoët, 1963)

1548 Direct elemental analysis of citrus crops by instrumental neutron activation. A rapid method for total bromide, chloride, manganese, sodium and potassium residues. (Castro and Schmitt, 1962)

II-H-3 INSECTICE RESIDUES IN SOIL

733 Gerolt, P. INVESTIGATION INTO THE PROBLEM OF INSECTICIDE SORPTION BY SOILS. Bull. World Hlth Org. 24, 4/5 (1961) 577-91.

Laboratory experiments were carried out to determine the effects of certain factors on the sorption of insecticides by the soils used in the construction of mudhuts; the test insects were adults of Musca domestica L. or Aedes aegypti (L.) and the insecticides were dieldrin, aldrin, DDT or γ BHC. In experiments with thin layers of homogenised mixtures of soil and insecticide, in which no diffusion took place, changes in relative humidity had a pronounced influence on the effectiveness of the insecticide, a 10% increase doubling the toxicity. Tests with DDT labelled with C^{14} showed that humidity was the only factor affecting toxicity. Studies with DDT, dieldrin and radioactive DDT showed that movement of insecticide in the soil was blocked at both very high and very low humidity, and that inward migration occurred only at intermediate humidities. Migration of water in the soil caused the insecticide to move in the same direction. As at a high relative humidity the inward migration of the insecticide is blocked, and as the initial loss in effectiveness by sorption is counterbalanced by the greater availability of the remaining toxicant, the application of the usual field dosage of 0.5 g dieldrin/m^2 remained effective for a considerable length of time. It seems, therefore, that sorption would be a problem in the field only when humidity was low. In the search for means of reducing sorption under dry conditions, promising results were obtained with wettable powders based on ground solidified melts of dieldrin and certain non-sorbable resins. (From auth. summary)

734 Weidhaas, D.E., Schmidt, C.H., Bowman, M.C. LOSS OF PARATHION AND DDT TO SOIL FROM AQUEOUS DISPERSIONS AND VERMICULITE GRANULES. J. econ. Ent. 54, 1 (1961) 175-7.

Both P^{32}-parathion and C^{14}-DDT were strongly adsorbed by soil from water dispersions. From two different volumes of water, the percentage loss of DDT to soil in 24 h was the same (78%), but the loss of parathion with the larger volume was about half (38%) that with the smaller volume. Bioassays of extracts of water and soil with larvae of Anopheles quadrimaculatus Say showed no appreciable loss in toxicity of parathion in 24 h. Tests with marsh water showed that large differences in pH, total solids, and chloride content had little effect on the distribution and codistillation of DDT at 0.02 ppm. Parathion was released into water readily from vermiculite granules; decreasing the concentration of parathion in the granules or increasing the depth and volume of water increased the percentage released at a given time. With vermiculite-DDT granules less than 20% of the DDT was found dispersed in the water at both 2 and 24 h which indicated that it was sloughed off at the time of application. (Auth.)

See also:

512 The degradation of methyl isothiocyanate-S^{35} in various soils. (Kötter et al., 1961)

687 Phorate accumulation by cotton plants and recovery from soil. (Hacskaylo et al., 1961)

II-J Radiomimetic Agents

735 Chamberlain, W.F. ABSORPTION, EXCRETION AND METABOLISM OF P^{32}-LABELED METEPA BY STABLE FLIES AND SCREWWORM FLIES. (Abstr. 233). Bull ent. Soc. Amer. 8, 3 (1962) 164.

The feeding or topical application of P^{32}-labelled metepa to stable flies or screwworm flies resulted in preferential absorption by stable flies and a preferential rate of excretion and metabolism by screwworm flies. The only significant metabolic product was phosphoric acid. (Auth.)

736 Plapp, F.W., Jr., Bigley, W.S., Chapman, G.A., Eddy, G.W. METABOLISM OF METAPHOXIDE IN MOSQUITOES, HOUSE FLIES, AND MICE. J. econ. Ent. 55, 5 (1962) 607-13.

The metabolic fate of a P^{32}-labelled sample of the chemosterilant metaphoxide (tris(2-methyl-1-aziridinyl) phosphine oxide) was investigated. In both larvae and adults of the mosquito Culex tarsalis Coquillett, degradation of the chemical was complete within 48 h of administration. Adult houseflies (Musca domestica L.) degraded 50% of large dosages of the chemical within 2 h. The rates of degradation were similar in a susceptible fly strain and in two organophosphate-resistant strains. In mice the observed rate of degradation was about the same as in houseflies. Metaphoxide and one major breakdown product, presumably phosphoric acid, were characterized by paper chromatography from excretory products of both houseflies and mice. (Auth.)

737 Weidhaas, D.E., McDuffie, W.C. HIGHLIGHTS OF RECENT RESEARCH ON CHEMOSTERILANTS FOR THE CONTROL OF INSECTS OF MEDICAL AND VETERINARY IMPORTANCE. Bull. ent. Soc. Amer. 9, 4 (1963) 268-72.

Up-to-date review article. To study the action of the chemosterilant metepa, P^{32}-labelled metepa was applied topically to Musca domestica L. It was rapidly absorbed and degraded. About 50% of the administered dose was absorbed and degraded in 1.5 - 2.0 h. Within 24 h, absorption and degradation were almost complete. Paper chromatographic studies indicated that much of the excreted radioactivity was unmetabolized metepa. More than 90% of the total P^{32} recovered in 24 h was excreted within 8 h of treatment. Similar studies showed that metepa was rapidly absorbed and metabolized in Culex tarsalis and white mice. Degradation of metepa was substantially complete within 48 h after administration to larvae and within 24 h for adults. No degradation appears to be caused by enzymes to other than those responsible for resistance to the organophosphorus compounds. Additional studies showed that P^{32}-labelled metepa was also rapidly absorbed and degraded by the common malaria mosquito Anopheles quadrimaculatus, the yellow-fever mosquito Aëdes aegypti, the screwworm, and the stable fly. The screwworm fly absorbed topically applied metepa only half as rapidly but excreted it twice as fast as the stable fly.

See also:

1172 Some effects of gamma radiation and apholate on the reproductive tissue of Drosophila melanogaster. (Henneberry and Cantwell, 1962)

1180 Preliminary observations on chemosterilization of mosquitoes. (Weidhaas et al., 1961)

1378 Mating ability of male mosquitoes, Aedes aegypti (L.), sterilized chemically or by gamma radiation. (Weidhaas and Schmidt, 1963)

PART II

IONIZING RADIATIONS

I BASIC RESEARCH

I-A Genetic and Cellular Effects

I-A-1 GENERAL ARTICLES. SURVEYS. BOOKS.

738 Anonymous. EFFECT OF NUCLEAR RADIATIONS ON INSECTS. Agric. Res. 2, 2(1962) 81.

Progress report by the Indian Council for Agricultural Research in New Delhi.

739 Астауров, Б.Л. ИОНИЗИРУЮЩИЕ ИЗЛУЧЕНИЯ И НАСЛЕДСТВЕННОСТЬ. ГЕНЕТИЧЕСКАЯ ТЕОРИЯ ЛУЧЕВОГО ПОРАЖЕНИЯ. Природа 4 (1962) 55-67.

Astaurov, B.L. IONIZING RADIATIONS AND HEREDITY. GENETICAL THEORY OF RADIATION DAMAGE. Priroda 4 (1962) 55-67.

Review article. On the basis of data from work on Drosophila melanogaster, Habrobracon, spores of Pteris longifolia, cells of Zygnaema, amoeba Proteus, the alga Acetabeluris, and on females of Bombyx mandarina and males of Bombyx mori, an explanation is attempted of the variety of ways in which the biological effects of radiation manifest themselves. They may range from radiation injury to induced mutations, and are generally treated separately. The author maintains that destruction of vital nuclear structures with accompanying damage to hereditary elements and their role in biosynthesis are the underlying causes of both radiation injury and mutation effects, the actual differences being due to the peculiarities of the particular living system considered. The general radiobiological concept put forward may be called the genetical theory of radiation injury.

740 Астауров, Б.Л. ФУНКЦИОНАЛЬНЫЙ ПРИНЦИП В ОЦЕНКЕ ОТНОСИТЕЛЬНОЙ ЗНАЧИМОСТИ РАДИАЦИОННЫХ ПОРАЖЕНИЙ ЯДРА И ЦИТОПЛАЗМЫ. (ГЕНЕТИЧЕСКАЯ ТЕОРИЯ ЛУЧЕВОЙ БОЛЕЗНИ). Стр. 140-61 в сб. "Труды Московского общества испытателей природы", т.7. 1963.

Astaurov, B.L. FUNCTIONAL APPROACH TO THE EXPLANATION OF THE RELATIVE BIOLOGICAL SIGNIFICANCE OF NUCLEAR VERSUS CYTOPLASMIC RADIATION LESIONS. (Genetic theory of radiation injury.) Trud. mosk. Obshch. Ispyt. Prir. 7 (1963) 140-61.

The relative significance of damage to nucleus and cytoplasm are reviewed in the light of different experimental results. Thus, heavy x-irradiation of the unfertilized egg of Bombyx mori (doses up to 500 000 r) does not prevent normal development, provided the irradiated egg is enucleated and development proceeds androgenetically with a heavily irradiated cytoplasm but with non-irradiated normal male nuclei. As demonstrated by Tultseva and Astaurov (Biophysics USSR, Engl. trans. 3:1958,183), triploid embryos of B. mori, for instance, are more resistant to x-radiation than diploid ones. Similarly, tetraploids are still more radioresistant than triploids. Good agreement on the correlation between polyploidy and radiosensitivity are obtained in some microorganisms, in numerous higher plants and in Habrobracon. It is concluded that the various biological effects of radiation are mostly due to initial destructive changes in the genetic elements of cell nuclei accompanied by their disfunction in the processes of constructive biosynthesis.

741 Bacq, Z. M., Alexander, P. "Fundamentals of Radiobiology". Oxford, Pergamon Press. 1961. 555p.

Comprehensive review of the whole field. The chapters on radiomimetic substances and on radiation effects at the cellular level are of particular interest in the present context. Individual insect cells appear to be more radioresistant than comparable individual cells of other organisms.

742 Borstel, R.C. von. EFFECTS OF RADIATION ON GERM CELLS OF INSECTS: DOMINANT LETHALS, GAMETE INACTIVATION AND GONIAL-CELL KILLING. p.367-83 in "Radiation and Radioisotopes Applied to Insects of Agricultural Importance. Proceedings of a Symposium, Athens, 22-26 April 1963". Vienna, International Atomic Energy Agency. 1963.

Review article. Radiations and chemical mutagens kill cells in numerous ways: by one of several kinds of induced dominant lethality, by a direct inactivation of function as with sperm, and by genetically undefinable types of death which may or may not be related to dominant lethality per se. Also, chemical mutagens appear to exert a curious enhancement of the fertilizing capacity of sperm. The different stages of oögenesis and spermatogenesis respond with unequal sensitivity to radiation, and individual cells pass through stages conferring as much as a 50-fold difference in sensitivity. Where species of Diptera, Hymenoptera and Coleoptera can be compared, a striking similarity of response to radiation can be observed, both to stage sensitivity and degree of response with dose. The silkworm, Bombyx mori (Lepidoptera), seems to be similar in most respects to representatives of the other orders in response of germ cells to radiation, but differs sharply in types of dominant lethality induced. Species having atypical genetic mechanisms (e.g., the lecanoid system of Planococcus citri (Hemipt.: Coccidae) are special cases, and their responses to radiation are considerably modified from those of other species. For insect population control by the irradiation-of-male method, dominant lethality is as advantageous in species where matings are multiple as in species where mating occurs once. Sperm inactivation and gonial killing can be regarded as instances of true sterility and are maximally effective only in species where mating occurs once. For most efficient control, doses should be chosen which would induce maximum dominant lethality, minimum sperm inactivation and complete killing of gonial cells. These parameters are simple to determine by gamete viability measurements, irradiated and unirradiated population competition experiments and histological examination of gonia. (Auth.)

743 Davidson, G., Mason, G.F. GENETICS OF MOSQUITOES. Annu. Rev. Ent. 8 (1963) 177-96.

The literature survey was concluded in February 1962. This review article is divided into sections on genetics of insecticide resistance, formal genetics of other characters, and hybridization and speciation. (Some work in which radiation (x-) was used to induce mutants in Culex pipiens molestus, C.p. fatigans, and Anopheles gambiae and to cause sterilization as in Anopheles quadrimaculatus is cited.)

744 Dubinin, N.P. PROBLEMS OF RADIATION GENETICS. "Problemy radiatsionnof genetiki, Moscow, 1961. Gosatomizdat. English Translation (Problems in Radiation Genetics) in AEC-tr-5376, Division of Biology and Medicine, AEC. Nov. 1962. 511p.

The whole field is reviewed. The book is divided into sections on the structural, physical and chemical bases of heredity; the physical nature of the biological action of radiation; the effect of ionizing radiation on heredity of animals, plants, microorganisms and viruses; the action of ultraviolet rays on heredity; the radiogenetic effect of visible light; radiation genetics of mammals; ionizing radiation and human heredity; radiation selection of plants and microorganisms; and concluding remarks. A total of 886 references are given. Results obtained from studies on grasshopper, Drosophila, and others cited.

745 Grosch, D.S. ENTOMOLOGICAL ASPECTS OF RADIATION AS RELATED TO GENETICS AND PHYSIOLOGY. Annu. Rev. Ent. 7 (1962) 81-106.

A comprehensive review article which is divided up into 9 main sections documented by 205 references. The subjects are broken down into gamete production; hatchability (exposure of embryos, exposure of parents); irradiation of larvae and pupae (survival, developmental abnormality); gene mutation; androgenesis; life span of adults (irradiated as adults, irradiation before adulthood); physiological aspects; radioisotope studies; population studies; and tissue culture.

746 Kimball, R.F. REPAIR AND DIFFERENTIAL SENSITIVITY TO MUTATION INDUCTION: SUMMARY AND SYNTHESIS. p.427-41 in "Repair from Genetic Radiation Damage". Sobels, F.H., Ed. Oxford, Pergamon Press. 1963.

Review of findings reported at Leiden 1962 symposium. Periods of mutagenesis, initial lesions, chromosomal aberrations, inactivation and mutation, dose rate and fractionation, and stage sensitivity are discussed. The author comments on the similarity, in diverse organisms, of the patterns of sensitivity for comparable germ cell stages.

747 Kondo, S. THEORETICAL ESTIMATION OF "SURVIVAL CELL NUMBER VERSUS DOSE" CURVE FROM EXPERIMENTAL FREQUENCY DISTRIBUTION OF THE NUMBER OF MUTANTS. Annu. Rep. nat. Inst. Genet., Mishima. 1961 12 (1961) 93-4.

748 Kortschak, H.P. MUTAGENIC EFFECT OF X-RAYS ON MOTHS. Nature, Lond. 196 (1962) 490.

Referring to the paper published by Müller et al., in Nature 194 (1962) 783 (ref. 750), the author disagrees with their interpretation, and states that the increase in mutation frequency for low doses is not less, but very much more than would be expected from the results of irradiation with higher doses.

749* Laven, H. VERERBUNG DURCH KERNGENE UND DAS PROBLEM DER AUSSERKARYOTISCHEN VERERBUNG BEI Culex pipiens. I. KERNVERERBUNG. (Nuclear gene heredity and the problem of extrakaryotic heredity in Culex pipiens. I. Heredity transmitted through the nucleus.)

The possibilities of Culex pipiens for genetic studies are considered, and its biology, breeding, and special techniques to be used are discussed. The need for inducing by irradiation the simple mutations required for such work has led to one particular series of experiments, in which 2-3 d old males were given 4000 r x-rays (42.4 r/min, 169 kV, 7-8 mA, 1 mm Al filter), followed by mating with non-irradiated females. A drop in eggs fertilized and larvae hatched was observed. The first generation showed 2 mutations (theoretically dominant), (Rap, Kpu). Subsequent breeding under specified conditions revealed also some recessive mutations, (var, kps). Radiation-induced and some spontaneous mutations are described. So far, 14 mutations have been isolated, of which 8 derived from x-irradiations, and 6 from spontaneous mutations. Three mutations are dominant, 6 recessive; 3 are sex-linked. Nuclear genes in Culex are transmitted normally, in accordance with Mendelian principles. - Part II, p.478-516 deals with "Ausserkaryotische Vererbung" (extrakaryotic heredity), and an analysis of crossing relations. It is followed by a listing of the literature cited in parts I and II.

750 Müller, I. MUTAGENIC EFFECT OF X-RAYS ON MOTHS. Nature, Lond. 196 (1962) 490-1.

Replying to Kortschak's criticism of his own (M's) deduction concerning the effect of very low doses of x-rays Müller stresses that somewhere between 10 and 20 r there must be a steep increase in mutation-frequency, possibly occurring as a rather sudden step which might imply the existence of a protective mechanism, destroyed by doses between 10 and 20 r.

751 National Inst. of Genetics, Mishima, Japan. ANNUAL REPORT OF THE NATIONAL INSTITUTE OF GENETICS No. 13. NP-13507. 1962. 121p.

Results are summarized from genetic studies in insects, mice, Salmonella, plants, and man. Emphasis was placed on studies on Drosophila, silkworms, wheat, rice, and forest trees. Data are included from studies of mutations induced by x-radiation in Drosophila and silkworm. A list is included of publications during the period. (From NSA 18: 1964, 8046)

752 Norsk Hydro's Inst. for Cancer Research, Oslo. FOURTH REPORT — FOR 1961 AND 1962. NP-13317. 1963. 58p.

Research activities of the Norsk Hydro's Institute for Cancer Research during 1961 and 1962 are summarized. Studies were conducted in the fields of radiobiology, pathology, genetics, biochemistry, and biophysics. A list is included of 122 papers published, or in press, as a result of the research programmes. (From NSA 18: 1964, 1321).

753 Ray-Chaudhuri, S.P. IONIZING RADIATIONS AND THE INDUCTION OF CHROMOSOME MUTATIONS IN THE GERM CELLS. Proc. Indian Sci. Congr. 2 (1961) 154-76.

Review of work done by the author and his associates on males of Gesonula punctifrons. Different sections are devoted to the different types of chromosomal aberrations (metaphase and anaphase abnormalities) induced by x-rays and absorbed P^{32}, and to the chemical protection afforded by sodium azide, versene (ethylenediaminetetraacetic acid), and cysteamine.

754 Russell, W.L. GENETIC HAZARDS OF RADIATION. Proc. Amer. phil. Soc. 107, 1 (1963) 11-17.

Includes mutation experiments with Drosophila.

755 Saint Louis University. SPONTANEOUS AND RADIATION MUTAGENESIS AND MUTABILITY IN Drosophila. FINAL REPORT JUNE 1, 1962-MAY 31, 1963. TID-19822. 1963. 18p.

Progress is reported in studies on the transgeneration transmission of nutrients through the egg or sperm of Drosophila, the effect of various nutrients in the growth medium on mutation rate in Drosophila, nonrandom assortment of nonhomologous chromosome elements in male D. melanogaster, and chromosome arrangement in mature sperm of Drosophila. (NSA 18 : 1964, 1322).

756 Wolff, S. RADIATION GENETICS. p. 419-75 in "Mechanisms in Radiobiology. Vol.I. General Principles". Errera, M., Forssberg, A., Eds. New York, Academic Press. 1961.

Review article. It aims to give an elementary background to the problems and theories in radiation genetics. Drosophila data are cited freely. The author discusses the types (intra- and intergenic) genetic effects; the effect of slow neutrons; the induction of mutations by cosmic and other natural radiations; gene size from target theory; dominant lethals; genetic effects of ultraviolet radiation; modification of x-ray-induced mutagenesis; the oxygen effect; and the effects of polyploidy on radiation-induced mutagenesis. 168 references cover relevant literature from 1927-1959.

See also:

1201 Cytological effects. (Tahmisian, 1961).

I-A-2 DOMINANT LETHALITY. STERILITY. CELL KILLING

757 Абелева, Э.А., Лапкин, Ю.А. О ЗАВИСИМОСТИ ЧАСТОТЫ ВОЗНИКНОВЕНИЯ ДОМИНАНТНЫХ ЛЕТАЛЬНЫХ МУТАЦИЙ В СПЕРМАТИДАХ ДРОЗОФИЛЫ ОТ ДОЗЫ ОБЛУЧЕНИЯ БЫСТРЫМИ НЕЙТРОНАМИ. Радиобиология 2, 2 (1962) 293-7.

Abeleva, E.A., Lapkin, Yu.A. DEPENDENCE OF THE FREQUENCY OF OCCURRENCE OF DOMINANT LETHAL MUTATIONS IN THE SPERMATIDS OF Drosophila UPON DOSE OF IRRADIATION WITH FAST NEUTRONS. Radiobiology 2, 2(1962) 181-7. AEC-tr-5429, March 1963. Translation from Radiobiologiya 2, 2(1962) 293-7.

The frequency of occurrence of dominant lethal mutations in spermatozoa of Drosophila subjected to fast-neutron doses from 600 to 2400 rads was found to be directly proportional to the radiation dose. In spermatids, the frequency of mutations for the range from 600 to 1200 rads on the dose curve was also found to be proportional to the dose, while it lagged considerably behind a linear dependence on dose over the range from 1200 to 2400 rads. In spermatids, the character of the dose-dependence of dominant and recessive lethal mutations induced by γ-rays, x-rays and fast neutrons was completely analogous. The RBE of neutrons in the case of spermatozoa is approximately 3 times greater than that of γ-rays, whereas in spermatids the neutron RBE is only 1.5 times higher. The radiosensitivity of spermatozoa to fast neutrons was found to approach that of spermatids. (From auth. conclusions).

758* Alexander, M.L. THE EFFECTS OF RADIATIONS ON THE GENETIC SYSTEMS OF ORGANISMS IN RELATION TO THEIR PHYSIOLOGICAL AND BIOCHEMICAL SYSTEMS. Progress Report, May 1, 1958-April 30, 1959. TID-17001, Texas. Univ., Houston. M.D. Anderson Hospital and Tumor Inst. 24p.

Still using the developing germ cells of Drosophila virilis the variations in radiosensitivity of non-dividing cells were shown to depend both on differences in sensitivity of the chromosomes for breakage and differences in enhancement of biological damage from environmental changes. A differential action upon cells in division and non-dividing cells was shown. Preliminary studies indicate that several lethal actions resulting from treatment of dividing cells can be separated and tested with the various radiations. Data are included on the effects of radiations from fission neutrons, accelerator neutrons, therapy x-rays, γ-rays, and 22-MV x-rays from a betatron accelerator. Germ cells of varying sensitivities were exposed in an atmosphere of O_2 or N_2 . Data are presented graphically. Results are included from a study of mutation rates at specific gene loci in mature sperm and spermatogonial cells of D. melanogaster. (From NSA 17 : 1962, 1237).

759* Alexander, M.L. THE EFFECTS OF RADIATIONS ON THE GENETIC SYSTEMS OF ORGANISMS IN RELATION TO THEIR PHYSIOLOGICAL AND BIOCHEMICAL SYSTEMS. Progress Report, May 1, 1959-April 30, 1960. TID-17002, Texas Univ., Houston. M.D. Anderson Hospital and Tumor Inst. 20p.

Further results are reported from studies on the effects of radiation dose rates on genetic damage in mature sperm and various types of germ cells of the spermatogenic cycle in Drosophila virilis. Tests were made